MICHIGAN STATE NORMAL COLLEGE
TRAINING SCHOOL DEPARTMENT.

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PROBLEMS IN THE EXPERIMENTAL PEDAGOGY OF GEOMETRY.

WILLIAM H. METZLER,
Syracuse University.

Geometry has always been considered a subject of high educational value, and therefore it has held its place in the curriculum without much question. Of late years it has, however, in common with other mathematical subjects, had to face the challenge to prove its right to the prominent place it has heretofore held. This challenge has for the most part come from the psychologists, who demand experimental proof for its claims. Another challenge, as to whether the traditional textbook method of teaching the subject is satisfactory, has recently come, more strongly, perhaps, than ever before, from some of the mathematics teachers themselves.

The different methods in vogue today of teaching any subject have not been built on speculative theory only, but are rather the cumulative results of the experiences of teachers in the past. These results have to a large extent come down to us by tradition, and therefore have been subject to the modifications of the changing conditions in the history of the world. Experiments have undoubtedly been performed here and there, and the results have been embodied in the formation of those methods, but what psychologists and others are now asking is that experiments and observations be made under careful conditions and in a systematic and scientific manner. The results can then be carefully studied, properly interpreted and recorded for future use.

The results which we should aim to obtain in the teaching of geometry are, for the ordinary student, as follows:

1. A knowledge of that part of the content which is fundamental and of most importance.

2. The ability to think logically, and a knowledge of the methods and principles of geometric proof and of the nature of proof in general.

These involve: (1) The ability to tell whether a given argument is logically sound and the habit of logically sound thinking. The student must learn to distinguish between necessary and contingent conclusions, and when the judgment has come to a decision as to the most probable hypothesis on which a contingent conclusion is based he should understand that the reasoning in reaching the conclusion is the same as that in reaching a necessary conclusion. (2) The ability to construct a chain of reasoning from given material. In geometry the student learns that he has certain tools by means of which he is to prove a proposition. He also learns how to examine these tools to see what ones are applicable, and then learns the general method of applying them. He learns to analyze, arrange and classify his material. He should then acquire the general methods which underlie all proofs so that when he comes to proofs in other subjects he has a clear knowledge of what constitutes a proof and of its general technique, and can apply it to whatever he may have to do. (3) The ability to think for himself. He must learn to look at a thing from all sides, to size it up in its true relations (which is good judgment). He must force every argument to its conclusion, and acquire the habit of thinking through and through a subject.

3. Ability to express himself clearly. The student must be taught the value and acquire the habit of clear expression.

4. Concentration. The ability to shut out everything else and fix the mind on the subject at hand is a prerequite to clear thinking, and must be insisted upon in geometry.

5. Constructive imagination. The ability to construct new images out of old elements. To be able to visualize and form the habit of doing so is of great importance.

6. Rational memory. The habit of associating things so as to retain them.

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7. Liberal-mindedness. The habit of always looking for new truth and leaving the mind open for its entrance. The student of geometry should be a discoverer, and get into the habit of looking for new light, as well as of looking at things form a broad standpoint.

8. Esthetic ability. Geometry possesses not only beauty of form, but of idea and of method. It should cultivate a habit of neatness and accuracy.

9. A spirit of honesty. The study of geometry soon shows the futility of dishonest thinking. It shows the reward of honest effort.

10. Will power. A well-governed will is essential to usefulness, and the study of geometry makes the student exercise it.

These results are not always obtained, but the aim should be to develop them as fully as possible. It is somewhat of a question as to how they are considered by teachers. Are all but content the incidentals—the mere by-products in the study of the subject, or are they the main object? It is to be feared that they are too often considered incidentals, and that altogether too little attention is given to them. In my estimation they are the chief aim, and the content the incidental, or the occasion for acquiring them. The mere content of most subjects is of little value as compared with the other mental and moral qualities, and the teacher of geometry should see to it that they are obtained from its study.

Not only should these powers be sought for, but they should also be sought for in a general way, and not as related to the subject at hand only. Concentration, for instance, should be insisted upon in connection with geometry, but the teacher should at the same time not limit its value to geomery,[1] but carefully point out that it is an ability of great value in everything. So all these powers, if they are insisted upon in connection with every school subject and taught from this general standpoint, will be applied by the student in connection with everything he undertakes in life.

There seem to be three fairly-well defined lines of experimental work which might be undertaken in connection with this subject. As to the foregoing results, three questions might be asked:

[1]It would be well at the very start to impress upon students of geometry the general value of the subject.

1. Are they obtained under any given method?
2. What is the best method of obtaining them?
3. If obtained, is there a transfer from geometry to other subjects?

Experiments in these directions, to be of value, must be performed with the utmost care and under the most certain conditions. So many elements of uncertainty enter that any one person may easily overlook some important factor and thereby spoil the value of the experiment. If the three lines of investigation indicated were carefully carried out and the questions involved settled, there would be no doubt as to the correct aims and proper methods in teaching the subject.

Considering these three questions in order, I would offer under the first, as guides for testing for three of the results and as suggested tests, the following:

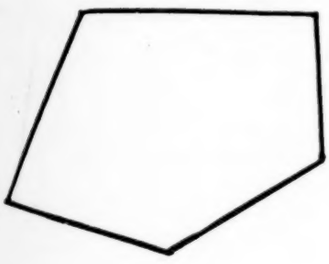
A. KNOWLEDGE OF FUNDAMENTALS; SUGGESTIONS FOR TESTS.

1. Give a series of geometrical figures and have the pupils write the names opposite in a limited time.
2. Give a list of geometrical terms and have the pupils in a limited time—
   (a) Define them informally.
   (b) Illustrate such as admit of illustration by a drawing.
   (c) Give additional properties (not included in the definition) of such as admit of them. These additional properties should not be made to include their relation to external things.
3. State the hypotheses of the fundamental propositions and have the student give the conclusions; time limited.
4. State the conclusions of such propositions and have the students give as many sufficient hypotheses as possible; time limited.

Suggested Test.

Name the following, using a single word or phrase. The marks indicate in several instances what is meant:

(1)



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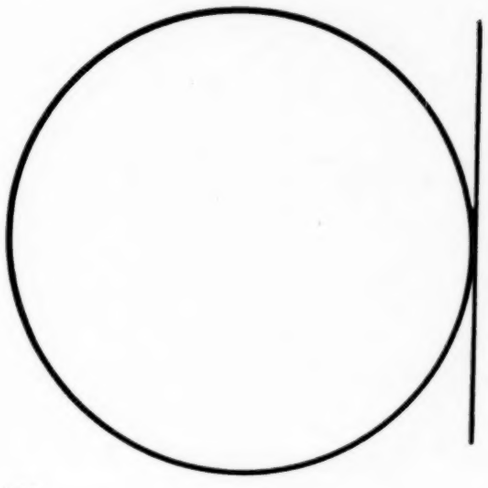

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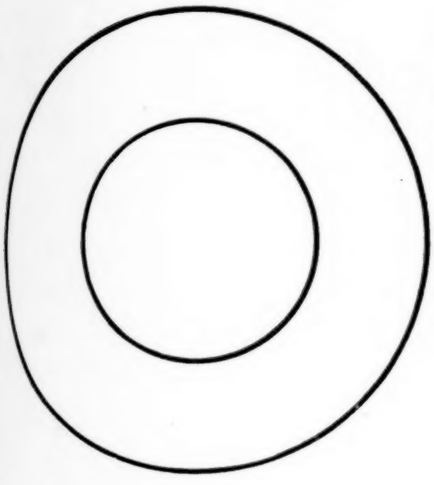

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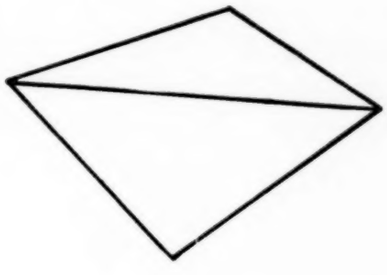

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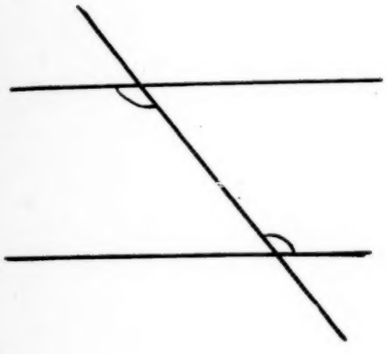

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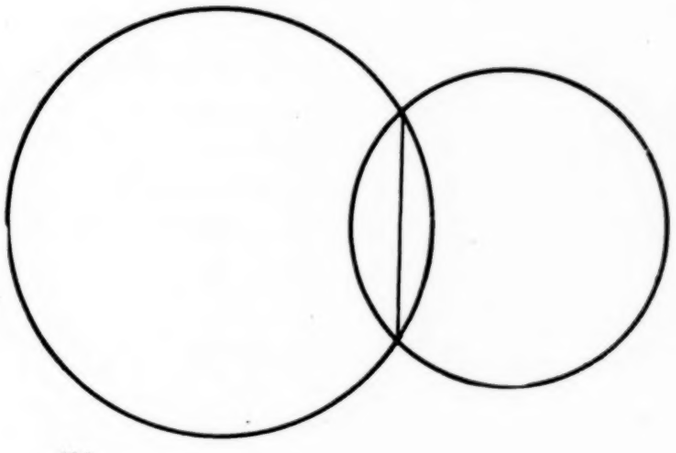

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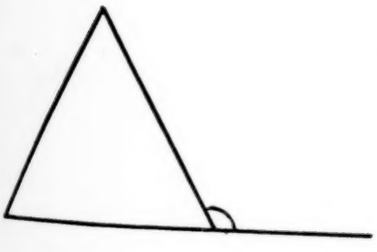

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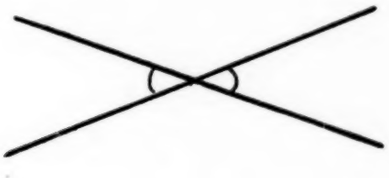

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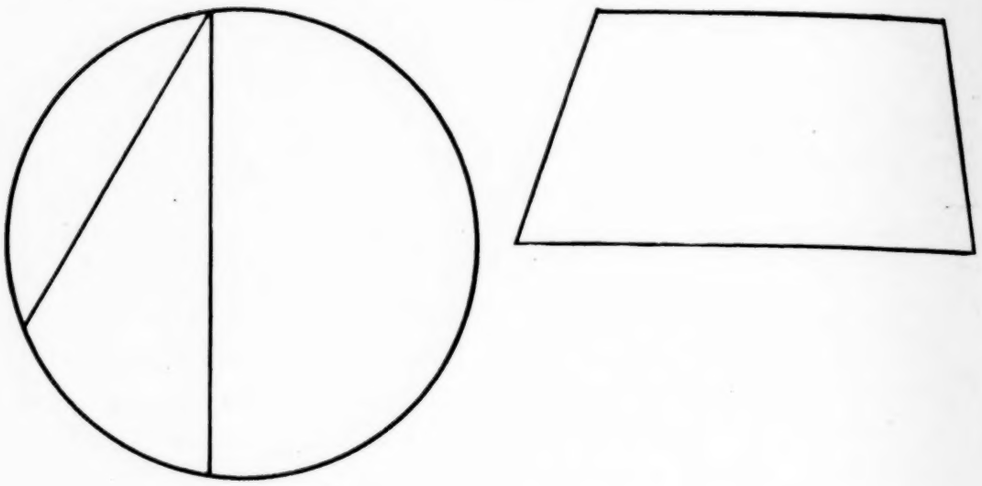


2. Define informally, illustrate by a drawing such as admit of illustration, and give additional properties (not included in the definition) of such as admit of them:

(1) Polygon.
(2) Parallelogram.
(3) Hypotenuse.
(4) Circle.
(5) Regular polygon.
(6) Apothem.
(7) Similar polygons.
(8) Adjacent angles.
(9) Inscribed angle.
(10) Perpendicular lines.
(11) Supplementary adjacent angles.
(12) Exterior angle of a triangle.
(13) Equilateral triangle.
(14) Projection of a line segment on another line.
(15) Locus.
(16) Altitude of a trapezoid.
(17) Base of a trapezoid.
(18) Area of a surface.
(19) Circumscribed polygon.
(20) Converse.
(21) Secant.

(22) Chord.
(23) Diagonal of a pentagon.
(24) A line segment divided externally.

3. Give conclusions for the following:
(1) If two parallel lines are cut by a transversal.....
(Three conclusions.)
(2) If two angles of a triangle are unequal.....
(3) The sum of the interior angles of a polygon equals .....
(4) If a line is the perpendicular bisector of a sect.....
(5) If a straight line is perpendicular to a radius where the radius meets the circumference.....
(6) In a triangle if a line is drawn cutting the sides and parallel to the base.....
(7) An angle formed by two chords intersecting within the circumference is measured by.....
(8) In any triangle the square on the side opposite an acute angle is equal to.....
(9) Two circumferences have the same ratio as.....
(10) The areas of similar polygons are as.....
(11) The area of a regular polygon is equal to.....
(12) If two triangles have an angle of one equal to an angle of the other, their areas.....
(13) The area of a circle is equal to.....
(14) The locus of the vertex of a right angle opposite a given fixed hypotenuse is.....
(15) If a perpendicular is drawn from the vertex to the hypotenuse of a right triangle.....

4. State the sufficient hypotheses in each of the following:
(1) Two angles are equal if.....
(2) Two straight lines are parallel if.....
(3) Two straight lines are perpendicular if.....
(4) Two sects (segments of straight lines) are unequal if.....
(5) Two triangles are congruent if.....
(6) A quadrilateral is a parallelogram if.....
(7) A sect is a mean proportional between two other sects if.....

(8) Two triangles are similar if.....
(9) A polygon is regular if.....
(10) Two parallelograms are congruent if.....

B. Reasoning, Geometrical and General; Suggestions for Tests.

1. Tests in geometry.
   (a) Give tests on originals (with time limited) at various stages of the study of the subject.
   (b) Have the students give a full description of the method used in analyzing the questions and the steps leading to their conclusions.

Observe from (a) the degree of ability to reason correctly, and from (b) the students' knowledge of the methods of logical attack and the ability to analyze their own thought processes. As the study of geometry proceeds there should be improvement if the pupil is grasping the subject.

2. Tests in other subjects.
   (a) Give tests in some subject, other than geometry (with time limited), involving reasoning of like logical difficulty and concerning data of equal familiarity as in geometry, but such tests should not be to reproduce proofs they may have already had.
   (b) As in 1 (b).

Observations similar to those made in 1 should be recorded. The test consists in observing whether the improvement in 2 (a) and (b) bears any ratio to the improvement in 1 (a) and (b).

Directions.—Test 2 should be given just before beginning the study of geometry, and both 1 and 2 at regular intervals throughout the course, and, if possible, other tests in 2 should be given at similar intervals after finishing the study of geometry. Test 2 should also be given, when possible, to pupils in the same year of high school who are not taking geometry, and the results compared with the results of those who are taking it. The differences should be carefully noted.

Suggested Tests.

1. Test in geometry.

(a) Draw and letter the figures and state the hypothesis and conclusion in terms of your notation in each case:

(1) The median from the vertex to the base of an isosceles triangle bisects the vertical angle.

(2) If one acute angle of a right triangle is double the other, the hypothenuse is double the shorter leg.

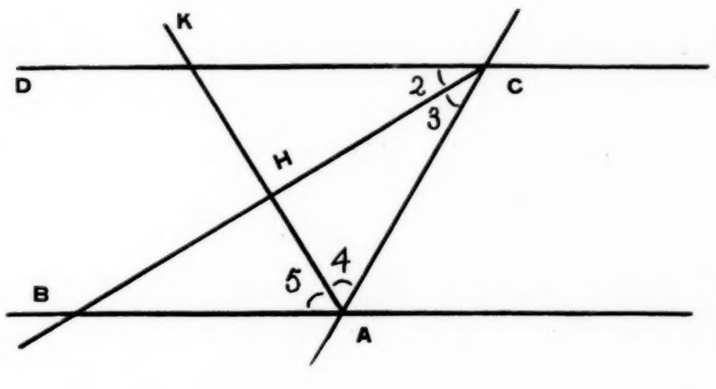
(3) The bisector of one of two vertical angles bisects the other.

(4) If the perpendiculars from two vertices upon the opposite sides in a triangle are equal, the triangle is isosceles.

(5) The line joining the middle points of the diagonals of a trapezoid is equal to half the difference of the bases.

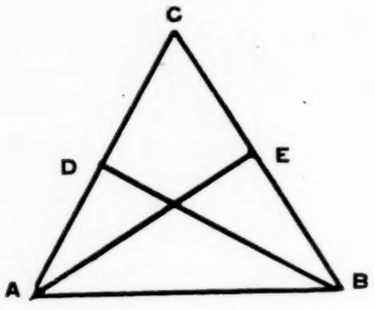
(b) Demonstrate the following; formulate the general statement without the use of reference letters:

(1)



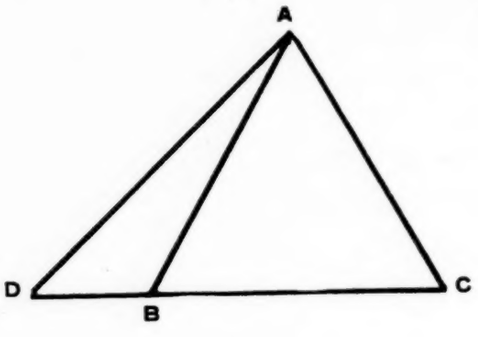
Given $\angle 2 = \angle 3$, $\angle 4 = \angle 5$, and $KA \perp CH$, prove $AB \parallel CD$.

(2)



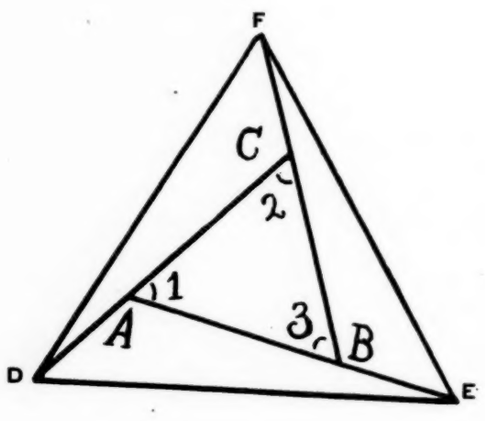
Given AE perpendicular to BC; given BD perpendicular to AC, and angle BAC equal to angle ABC, show that angle BAE is equal to angle ABD.

(3)



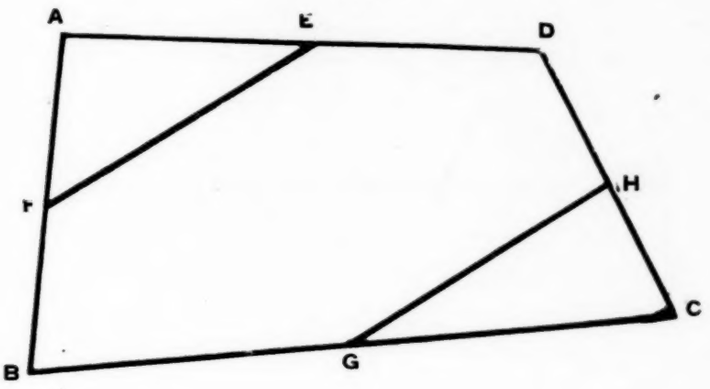
Given AB equal to BC equal to CA, show that AD is less than CD.

(4)



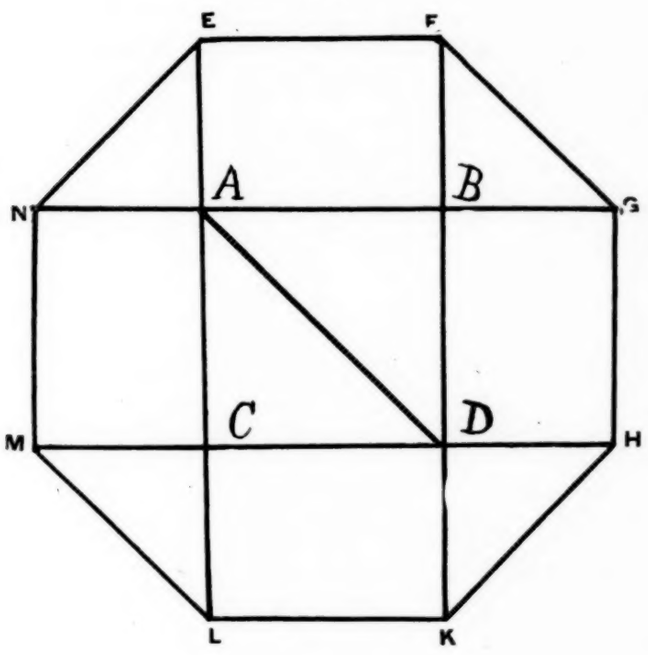
Given the angles 1, 2, 3 equal, and AD, BE, CF equal, show that DE is equal to DF.

(5)



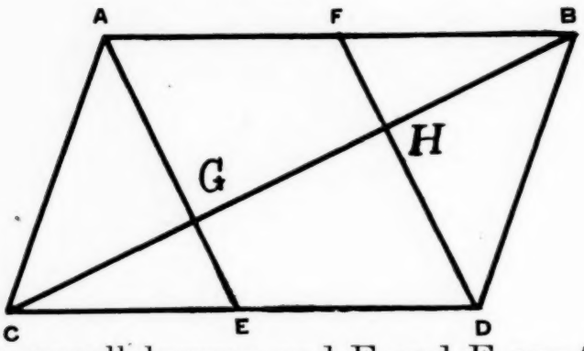
Given E, F, G, H, the midpoints of the sides of ABCD, show that FE is parallel to GH.

(6)



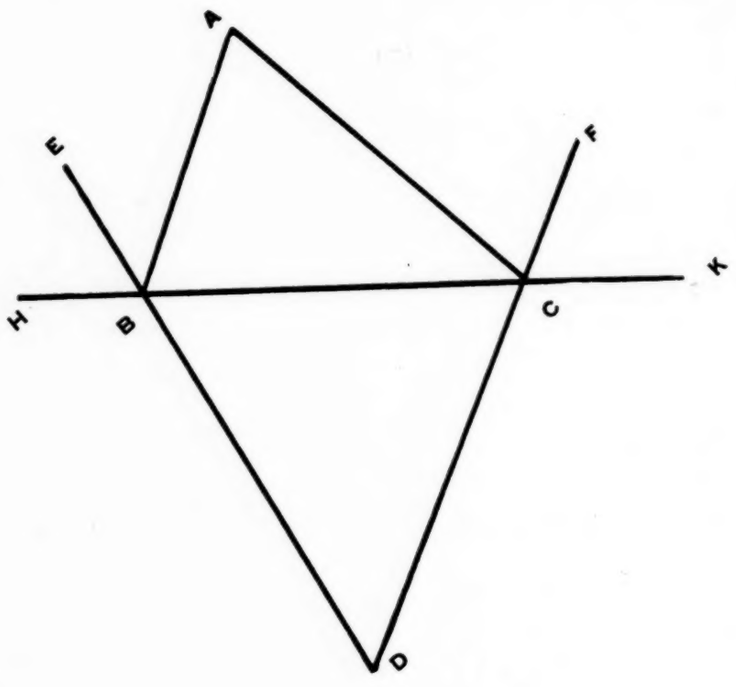
Given ABCD, a square, and AN, AE, BF, BG, DH, DK, CL, CM, each equal to one-half of AD, prove EFGHKLMN is a regular octagon.

(7)



ABCD is a parallelogram and E and F are the midpoints of AB and CD. Prove that CG = GH = HB.

(8)



DE and DF bisect the angles HBA and KCA. Prove that angle EDF = ½ (ABC + BCA).

NOTE.—A good test would be to give figures and ask the student to prove all the propositions they can connected with it. For instance, the figure

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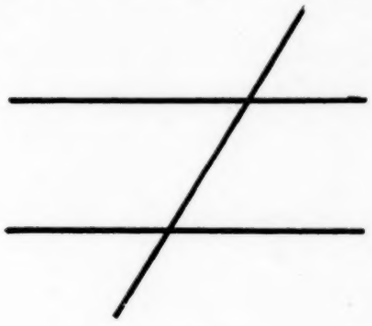


would involve several propositions.

(c) Demonstrate:

(1) If two circles are tangent externally at A, the tangents to them from any point on the common tangent at their point of contact are equal.

(2) If two circles intersect at P and Q, and PA and PB are diameters, then QA and QB are in the same straight line.

(3) If the bisector of the angle A of an inscribed triangle ABC meets BC in D and the circumference in P, then $AB \times AC = AD \times AP$.

(4) To draw a circle with a given radius that will pass through a given point and be tangent to a given line.

(5) A chord 24 inches long is 9 inches from the center of a circle; find the length of the tangents drawn from the extremities of the chord and produced till they meet.

(d) Demonstrate:

(1) If the diagonals of a trapezoid are equal, the trapezoid is isosceles.

(2) If perpendiculars be drawn from any point within an equilateral triangle to the three sides, their sum is equal to the altitude of the triangle.

(3) The area of the ring included between two concentric circles is equal to that of a circle whose radius is one-half of a chord of the outer circle drawn tangent to the inner.

(4) Prove that if one leg of a right triangle is the diameter of a circle, the tangent at the point where the circumference cuts the hypotenuse bisects the other leg.

(5) What is the locus of the midpoint of one leg of a right triangle whose hypotenuse is fixed? Prove the correctness of your answer.

2. Tests in other subjects.

(a) Starting with each of the following propositions in turn as true, state which of the others must then be true, which may then be true, and which cannot then be true.

(NOTE.—It is assumed that there exist things which are solids, things which are not solids, things which are crystals, and things which are not crystals.)

(1) All crystals are solids.
(2) Some solids are not crystals.
(3) Some not crystals are not solids.
(4) No crystals are not solids.
(5) Some solids are crystals.
(6) Some not solids are not crystals.
(7) All solids are crystals.

For instance:

If 7 is true, 3, 5, 6 must be true; 1, 4 may be true, and 2 cannot be true.

(b) What conclusions (if any) can be drawn from each pair of the following statements?

(1) None but residents are members of the club.
(2) Some members of the club are not officers.
(3) All members of the club are invited to compete.
(4) All officers are invited to compete.

(c) Point out any defects in the reasoning in the following cases:

(1) It is impossible to maintain that the virtuous alone are happy, and at the same time that selfishness is compatible with happiness, but incompatible with virtue.

(2) Bullies are always cowards, but not always liars; liars, therefore, are not always cowards.

(NOTE.—Test (a) can be repeated at frequent intervals by changing the order of the sentences and substituting other words for "crystal" and "solids.")

(3) Most M is P; most S is M; therefore, some S is P.

C. CONCENTRATION; SUGGESTIONS FOR TESTS.

1. Tests with unusual distractions.
   (a) Give (under distractions of some definite kind, such as the ticking of a metronome, the reading aloud of an interesting book, or the conducting of a recitation in the same room) tests (with time limited) to work out some originals that require concentration. Give these from time to time, and in so far as possible use originals of about the same difficulty and familiarity of principle involved, and see if the time required diminishes with the length of time geometry has been studied.
   (b) Same as in (a), using other than geometrical exercises.
2. Tests without unusual distractions.
   (a) Same as in 1, (a).
   (b) Same as in 1, (b).

Directions.—If possible, test 2, (b), should also be given to pupils in the same grade of high school who are not studying geometry, and the results compared with the results of those who are taking it. The differences should be carefully noted.

Suggested Tests.

The foregoing tests would serve very well for tests in concentration. Series (a), (b), (c) could be given at different times.

Under the second question as to what is the best method of obtaining the desired results it may be said that, besides many special devices, there has come to be three fairly well recognized general methods of teaching the subject. They are: the textbook method, the suggestive method, and the syllabus method. To determine which of these is best, or the relative merits of special devices, one should by well-selected experiments test the results. As different schools use different methods, the results might be compared by giving the same test to different schools.

To test for transfer is not by any means in all cases an easy

problem, and in some of its phases it would seem almost, if not entirely, impossible. Tests for some phases, viz., reasoning, concentration, etc., have been already suggested, and tests for other phases could be devised.

As has been pointed out, to obtain the results from the study of geometry enumerated above as general, and not peculiar to the subject only, it must be taught with them in view. They must be made objects themselves worthy of acquisition. In view of this, experiments to test the transfer of accuracy from numerical calculation to reasoning in arithmetic do not signify much unless we know from what standpoint and with what object accuracy in connection with numerical work has been taught. It is not sufficient to leave a power or habit to purely accidental acquirement. It must be taught as something in itself worthy of possession. We would hardly expect a boy to be honest if honesty was never mentioned to him except to have it impressed upon him that he should be honest with his teacher. He must be taught the importance of honesty with everyone and everywhere.

Possibly some will say that teaching abilities and habits such as accuracy in this general way in connection with numerical computation one is not teaching it here only, but in connection with everything. While there may be some truth in this, it is also true that if accuracy is taught in this way in connection with every subject in the curriculum, it will go with the pupil all through life and be transferred by him to everything he undertakes. That which is impressed upon one from a few standpoints, or taught as of importance in connection with but one or two subjects, is not likely to be considered of much importance in others, and will not become a habit in all.

Perhaps no subject teaches anything in itself, but simply furnishes the means for bringing out the lesson. As some occasions furnish better opportunities than others for instilling lessons, so some subjects are perhaps better suited than others for getting the mind in the best psychological condition to be impressed by and to possess some of these powers.

AN INVESTIGATION ON THE VALUE OF DRILL WORK IN THE FUNDAMENTAL OPERATIONS OF ARITHMETIC.

Part II.

J. C. BROWN,
Horace Mann High School, New York City.

(*Concluded from the November number.*)

A comparison will now be made of the records of the 19 pupils of the non-drill sections, who did poorest work on the first test, with the average records for the non-drill sections. Later a comparison will be made between the poorest 19 and the best 19 of the non-drill sections.

Comparison of the poorest 19 *of non-drill sections with entire non-drill sections.*

(These 19 cases are selected on the records made on first test.)

Poorest 19 on first test made an average of 15.2 points and median of 15 points.
Average on first test of all non-drill pupils = 26.1 points and median of 28 points.
Poorest 19 were 41 per cent. below arithmetical average and 46 per cent. below the median on first test.
Poorest 19 on second test made an average of 19 points and median of 19 points.
Average on second test of all non-drill pupils = 28.6 points and median of 25 points.
Poorest 19 on second test were 33 per cent. below arithmetical average and 33.5 per cent. below the median.
Of the poorest 19 in the non-drill classes, 8 were boys and 11 were girls.

Of the poorest 19 in the non-drill classes, 7 were from City D, 9 from City M, and 3 from City C.

The average age of the poorest 19 of the non-drill classes was 2.4 per cent. greater than the average age of all pupils in the non-drill classes. Four of these 19 pupils had been retarded in either the fifth or sixth grades, or both.

Comparison of best 19 *of non-drill section with entire non-drill section, based on total number of points made on first test.*

Best 19 on first test made average of 36.2 points and median of 35 points.

Average on first test of all non-drill classes = 26.1 points and median of 28 points.

Best 19 were 38.8 per cent. above arithmetical average and 25 per cent. above the median on first test.

Best 19 on second test made average of 32.7 points and median of 29 points.

Average on second test of all non-drill classes = 28.6 points and median of 19 points.

Best 19 on second test were 14.3 per cent. above arithmetical average and 52.6 per cent. above the median.

Of the best 19 in the non-drill class, 14 were boys and 5 were girls.

Of the best 19 in the non-drill class, 10 were from City D, 1 from City M, 2 from City C, and 6 from P.

The average age of the best 19 of the non-drill classes was 2.4 per cent. greater than the average age of all pupils in these classes, and was exactly the same as that of the poorest 19. Two of the best 19 had been retarded in either the fifth or sixth grades, or both; four of the poorest 19 had been similarly retarded.

Comparison of the best 19 *and the poorest* 19 *of the non-drill sections, based on total number of points on first test.*

Best 19 on first test made an average of 36.2 points and a median of 35 points.

Poorest 19 on first test made an average of 15.2 points and a median of 15 points.

Best 19 on first test were 38.8 per cent. above arithmetical average and 25 per cent. above median.

Poorest 19 on first test were 41 per cent. below arithmetical average and 46 per cent. below median.

Best 19 on second test made an average of 32.7 points and median of 29 points.

Poorest 19 on second test made an average of 19 points and median of 19 points.

Best 19 on second test were 14.3 per cent. above arithmetical average and 52.6 per cent. above median.

Poorest 19 on second test were 33 per cent. below arithmetical average and 33.5 per cent. below median.

On first test best 19 scored 3.1 times as many points as poorest 19.

On second test best 19 scored 2 times as many points as poorest 19.

Comparison of poorest 19 *of drill sections with combined drill sections, based upon total number of points scored on first test.*

Poorest 19 on first test made an average of 13.1 points and a median of 12 points.

Average on first test of all drill pupils was 26.6 points and a median of 28 points.

Poorest 19 were 50.7 per cent. below arithmetical average and 50 per cent. below median on first test.

Poorest 19 on second test made an average of 25.1 and a median of 22.

Average on second test of all drill classes was 33.3 and a median of 37 points.

Poorest 19 were 23.7 per cent. below arithmetical average and 40.5 per cent. below the median on second test.

Of the poorest 19 in the drill sections, 8 were boys and 11 were girls.

Of the poorest 19 in the drill sections, 5 were from City D, 8 from City M, 5 from City C, and 1 from City P.

The average age of the poorest 19 in the drill sections was 12.9, which was 5.7 per cent. greater than the average age of all pupils examined and 2.3 per cent. greater than the average age of the best 19 in the drill sections.

Comparison of best 19 *of drill section with entire drill section, based upon total number of points made in first test.*

Best 19 on first test made average of 41.2 points and median of 39 points.

Average on first test of all drill classes was 26.6 and median was 28.

Best 19 were 54.8 per cent. above arithmetical average and 39 per cent. above median on first test.

Best 19 on second test made average of 50.14 points and median of 45 points.

Average on second test of all drill classes was 33.3 and median of 37 points.

Best 19 were 50.5 per cent. above arithmetical average and 21.3 per cent. above median on second test.

Of the best 19 in the drill sections, 10 were boys and 9 were girls.

Of the best 19 in the drill sections, 5 were from City D, 5 from City M, 3 from City C, 6 from City P.

The average age of the best 19 in the drill sections was 3.1 per cent. greater than the average age of all pupils examined, and was 2.3 per cent. lower than the average age of the poorest 19 in the drill sections.

Four of the best 19 in the drill sections had been retarded in the fifth or sixth grades, or both, and 9 of the poorest 19 had been similarly retarded.

Comparison of best 19 *and poorest* 19 *of drill sections, based on total number of points scored in first test.*

Best 19 on first test made an average of 41.2 points and a median of 39 points.

Poorest 19 on first test made average of 13.1 points and a median of 12 points.

Best 19 on first test were 54.8 per cent. above the average and 39 per cent. above the median.

Poorest 19 on first test were 50.7 per cent. below the average and 50 per cent. below the median.

Best 19 on second test made average of 50.14 points and a median of 45 points.

Poorest 19 on second test made average of 25.1 points and a median of 22 points.

Best 19 on second test were 50.5 per cent. above the average and 21.3 per cent. above the median.

Poorest 19 on second test were 23.7 per cent. below the average and 40.5 per cent. below the median.

On first test best 19 scored 3.1 times as many points as poorest 19.

On second test best 19 scored 1.9 times as many points as poorest 19.

The effect of the drill here, as was the case in the first study, seems to be greatest on the poorest portion of the class. It decreases the variability of a given class.

The following tables are the basis upon which the conclusions immediately preceding are based:

Based on record of first test. Non-drill sections. Poorest nineteen.

Cases.	Total Points First Test.	Total Second Test.	Gain.	Gain. Per Cent.	First Six Probs. First Test.	First Six Probs. Second Test.	Per Cent. Gained on First Six.	Age.	City.	Boy.	Girl.
1	11	15	4	36.3	11	15	36.3	14	D		X
2	11	16	5	45.4	11	16	45.6	13	D		X
3	11	30	19	173	11	30	173	11	M		X
4	12	20	8	66	12	20	66	11	M		X
5	13	17	4	30.7	13	17	30.7	14	M		X
6	14	13	—1	—7.1	14	13	—7.1	11	C	X	
7	14	18	4	28.5	14	18	28.5	13	M		X
8	14	19	5	35.7	14	19	35.7	11	M	X	
9	14	19	5	35.7	14	19	35.7	11	M	X	
10	15	21	6	60	15	21	60	12.5	D		X
11	15	25	10	66.6	15	25	66.6	11	D		X
12	16	14	—2	—12.5	16	14	—12.5	14	M		X
13	17	26	9	52.9	17	26	52.9	13	M		X
14	18	14	—4	—22.2	18	14	—22.2	14	M	X	
15	18	12	—6	—33.2	18	12	—33.2	15	D		X
16	19	20	1	5.2	19	20	5.2	11	C	X	
17	19	18	—1	—5.2	19	18	—5.2	12	D	X	
18	19	27	8	42.1	19	27	42.1	12.5	D	X	
19	19	21	2	10.5	19	21	10.5	14	C	X	
Totals....	289	372	73	608.6	289	372	608.6	238		8	11
Arith. Av.	15.2	19.0	3.8	32.01	15.2	19.0	32.01	12.5			
Med.....	15	19	4	35.7	15	19	35.7				
Mode....	14, 19	..	5	35.7	14, 15	..	35.7				

Based on record of first test. Non-drill sections.
Best nineteen.

Cases.	Total Points First Test.	Total Second Test.	Gain.	Per Cent. Gain.	First Six Probs. First Test.	First Six Probs. Second Test.	Per Cent. Gained on First Six.	Age.	City.	Boy.	Girl.
1	45	40	—8	16.6	28	31	10.7	14	D	X	
2	46	34	—12	—26	31	30	—3.2	11	P		X
3	42	28	—14	—33.3	32	27	—15.6	14	D	X	
4	41	51	—10	23.8	31	32	3.2	12	P		X
5	39	30	—9	—20.9	29	24	—17.2	12.5	P	X	
6	37	30	—7	—18.9	32	30	—6.6	13	D		X
7	36	32	—4	—11.1	32	31	—3.1	11.5	D		X
8	36	30	—6	—16.6	32	30	—6.6	14	M	X	
9	35	32	—3	—8.3	31	30	—3.2	11	D	X	
10	35	29	—6	—17.1	31	28	—9.6	12	D	X	
11	34	47	13	37.1	30	31	3.3	12	P	X	
12	33	26	—7	—21.2	23	27	—17.3	12	D	X	
13	33	27	—6	—17.6	31	26	—16.1	11	D	X	
14	32	51	+19	59.3	31	25	—19.3	11	D	X	
15	32	25	—7	—21.8	32	25	—21.8	15	C	X	
16	32	23	—9	—28.1	32	20	—37.5	13	C		X
17	32	32	0	0	32	32	0	11	P	X	
18	32	27	—5	—15.6	29	25	—14.1	13.5	D	X	
19	32	26	—6	—18.7	32	23	—28.1	12.5	M	X	
Totals....	687	620	—67	—170	581	527	.....	238		14	5
Arith. Av.	36.2	32.7	—3.5	—9	30.6	30.6	—9.3	12.5			
Median...	35	29	—6	—17.1							
Mode....	32	30	—6	.....							

Based on record of first test. Drill section.
Poorest nineteen.

Cases.	Total Points First Test.	Total Second Test.	Gain.	Per Cent. Gain.	First Six Probs. First Test.	First Six Probs. Second Test.	Per Cent. Gained on First Six.	Age.	City.	Boy.	Girl.
1	7	26	19	271.42	7	24	242.8	12	M		X
2	10	12	2	20	10	12	20	12	M		X
3	10	19	9	90	10	19	90	14.5	C	X	
4	18	15	—3	—16.6	18	12	—33.3	11	M		X
5	10	50	40	400	29	31	+6.9	12	P	X	
6	11	15	4	36.4	11	15	36.4	16.5	D		X
7	11	26	15	83.3	18	32	77.7	10.0	M		X
8	11	33	21	190.9	11	28	154.5	11	C		X
9	12	16	4	33.3	12	16	33.3	14	M		X
10	12	20	8	66.6	12	20	66.6	11	M		X
11	12	21	9	75	12	21	75	13	M		X
12	12	23	11	91	12	23	91	12	D		X
13	12	30	18	150	12	27	125	14	C	X	
14	13	26	13	100	13	26	100	15	C	X	
15	15	17	2	13.3	13	17	13.3	15	M		X
16	16	29	13	81.2	16	29	81.2	12.5	C	X	
17	17	19	2	10.6	17	19	10.6	14	D	X	
18	17	27	10	58.8	17	27	58.8	15	D	X	
19	17	31	14	82.3	17	22	29.3	12	D	X	
Totals....	250	469	219	1857.4	255	401	.....	246		8	11
Arith. Av.	13.1	25.1	12	97.7	14.1	21.1	+57.2	12.9			
Median...	12	22	10	90							
Mode.....	12	.....		.....							

Based on record of first test. Drill section. Best nineteen.

Cases.	Total Points First Test.	Total Second Test.	Gain.	Per Cent. Gain.	First Six Probs. First Test.	First Six Probs. Second Test.	Per Cent. Gained on First Six.	Age.	City.	Boy.	Girl.
1	62	76	14	22.6	32	32	0	13	P	X	
2	57	69	12	21	26	32	23.0	14.5	C		X
3	50	53	3	6	32	32	0	11	D	X	
4	49	48	—1	—2	29	30	3.4	13	P	X	
5	46	51	5	10.9	32	31	—3.1	11	C		X
6	42	48	6	14.2	32	30	—6.6	12	P		X
7	42	36	—6	—14.2	32	32	0	12	D	X	
8	41	49	8	19.5	31	31	0	11.5	C		X
9	40	53	13	32.5	31	32	3.2	12	M		X
10	39	47	8	20.5	30	31	3.3	12	D	X	
11	38	44	6	15.8	28	31	10.6	15	M		X
12	37	38	1	2.7	32	30	—6.6	15	D		X
13	37	52	15	40.5	32	29	—9.3	12	P	X	
14	36	80	44	125	31	23	—25.8	13	P	X	
15	34	44	10	29.4	25	32	28	12	P		X
16	34	37	3	8.8	32	31	—3.1	12	M	X	
17	34	34	0	0	31	31	0	14	M	X	
18	33	54	21	63.6	32	31	—3.1	12	M		X
19	33	31	—2	—6	32	25	—21.8	12	D	X	
Totals....	784	954	170	411.2	582	576	.....	239			
Arith. Av.	41.2	50.14	8.94	21.1	30.6	30.3	—1	12.6		10	9
Median...	39	45	6	15.8							
Mode.....	34	.....	.....	.....							

Comparison of the best and poorest 19 of the non-drill sections, based upon gross gain in points.

The best 19 of the non-drill classes made a gain ranging from 6 to 19 points, with an average gain of 10 points and a median gain of 9 points.

The poorest 19 of the non-drill classes made a gain ranging from (— 17) to (— 6), with an average gain of (— 8) points and a median gain of (— 5) points.

The greatest gain of the best 19 represented a gain of 59.8 per cent. on the record of the first test. The least gain of the best 19 represented a gain of 40 per cent. on the record of the first test.

The greatest gain of the poorest 19 represented a gain of (— 18.9 per cent.) on the record of the first test; the least gain of the poorest 19 represented a gain of (— 54.8 per cent.) on the record of the first test.

Comparison of the best and poorest 19 *of the drill sections, based on gross gain in points.*

The best 19 of the drill classes made a gain ranging from 18 to 46 points, with an average of 26 points, and a median gain of 22 points.

The poorest 19 of the drill classes made a gain ranging from (— 13) to + 1 points, with an average of (— 3.1) points, and a median gain of (— 2) points.

The greatest gain of the best 19 represented a gain of 148.3 per cent. on the record of the first test, and the least gain represented a gain of 72.7 per cent. on the record of the first test.

The greatest gain of the poorest 19 represented a gain of 3.1 per cent., and the least gain of the poorest 19 represented a gain of (—37.1 per cent.) on the record of the first test.

Comparison of the best and poorest 19 *of drill class with best and poorest* 19 *of non-drill class, based upon gross gain in points.*

Best 19 of drill classes made gain ranging from 18 to 46 points, average 26 points.

Best 19 of non-drill classes made gain ranging from 6 to 19 points, average 10 points.

Best 19 of drill classes made a median gain of 22 points.

Best 19 of non-drill classes made a median gain of 9 points.

Poorest 19 of drill classes made gain ranging from (— 13) to + 1 points, average (— 3.1).

Poorest 19 of non-drill classes made gain ranging from (— 17) to (— 6) points, average (— 8).

Poorest 19 of drill classes made median gain of (— 2) points.

Poorest 19 of non-drill classes made median gain of (— 5) points.

Greatest gain of best 19 of drill classes was 148.3 per cent. on previous record.

Greatest gain of best 19 of non-drill classes was 59.8 per cent. on previous record.

Greatest gain of poorest 19 of drill classes was 3.1 per cent. on previous record.

Greatest gain of poorest 19 of non-drill classes was (— 18.9) on previous record.

Least gain of best 19 of drill classes was 72.7 per cent. on previous record.

Least gain of best 19 of non-drill classes was 40 per cent. on previous record.

Least gain of poorest 19 of drill classes was (— 37.1 per cent.) on previous record.

Least gain of poorest 19 of non-drill classes was (— 54.8 per cent.) on previous record.

In all of the preceding tables it appears that the improvement made by members of the drill classes averages from two to three times as much as the improvement made by the non-drill classes.

The data of this study corroborate in every essential particular the data and the conclusions of the first study. In comparing the results of the first and second studies it should be recalled that the results of the first study followed a drill period of 30 recitations and those of the second study followed a drill period of 20 recitations.

A summary of the results attained by the drill classes in the first and second study will now be given.

Summary of the results attained by the drill classes in the first and second study.

In the first study drill classes made an improvement of 21.2 per cent. on number of problems worked.

In second study drill classes made an improvement of 16.9 per cent. on number of problems worked.

In first study drill classes made an improvement of 33.4 per cent. in addition.

In second study drill classes made an improvement of 18.5 per cent. in addition.

In first study drill classes made an improvement of 36.9 per cent. in subtraction.

In second study drill classes made an improvement of 32 per cent. in subtraction.

In first study drill classes made an improvement of 30 per cent. in multiplication.

In second study drill classes made an improvement of 24.1 per cent. in multiplication.

In first study drill classes made an improvement of 28 per cent. in division.

In second study drill classes made an improvement of 34.2 per cent. in division.

In first study drill classes made an improvement of 32 per cent. in total number of points.

In second study drill classes made an improvement of 24.2 per cent. in total number of points.

In first study drill classes made an improvement of 5.8 per cent. on first six problems.

In second study drill classes made an improvement of 11.7 per cent. on first six problems.

The greater increase in accuracy in the second study is probably accounted for by the fact that the pupils to whom the first test was given had previously acquired a relatively high standard of accuracy.

None of the data collected indicates that boys are either more or less influenced by drill than girls. The effect of the drill was practically the same.

A future issue of this JOURNAL will contain the results of an investigation to determine when the maximum effects of five minutes' drill in arithmetic is attained.

THE CHILD'S SPEECH.

III. Speech Without Words.

ROBERT MACDOUGALL,
New York University.

1. Two great types have often been discriminated in the expression of human attitudes, which differ in the materials upon which they depend as largely as in the content of meaning which they reveal—types which are unlike equally in function and history. The language of thought is articulate, the language of feeling inarticulate. The latter depends for its form upon diversities of pitch and quality and their fluent modulations. The former is monotonous in its qualitative elements, but highly diversified in its articulate forms.

The language of feeling is natural and common to all men, untaught and spontaneous; the language of thought is artificial in its construction and is acquired from those who already possess it. Its features are subject to constant variation and development, since it does not rest upon any natural and proper type to which the individual tends to revert in the absence of a special model. The forms of speech possessed by two branches of a common stock, therefore, will be diversified in proportion to the differences in the conditions under which they live and the period of time during which they have been separated.

2. The language of feeling is also subject to conventionalization, but each individual and generation, apart from the inheritance of a social tradition, will fall back upon a natural type of expression which is common to the species. The utterance of feeling is thus universal and permanent, while that of thought is variable and common only to those who are members of a single social group. Feeling is expressed alike by the child and the adult; it is manifested before the process of

imitation has been set up; it persists until the end of life. Its form becomes clearer and approaches more closely to the fundamental type in proportion as the condition of excitement mounts and the conventions of social usage are in consequence swept aside.

Of this inarticulate language through which human feeling is expressed the sigh, the shriek, the groan, the laugh, the wail are typical examples. These forms of utterance are common to all races and ages of man; they are the expression of clearly differentiated experiences in respect to the affective overtone by which they are characterized, and it is this quality of feeling which such inarticulate utterances express. They tell of danger, delight, wonder, grief, suffering, fury, terror, but convey no intelligence of the situation which has given rise to these feelings. The intellectual analysis of the experience calls for a different type of expression which it is the aim of articulate speech to supply.

3. From this inarticulate expression of affective states the system of articulate language later arises. The child begins life with a cry, which is in part a physiological reaction, but which one cannot but regard as also in part an expression of the affective tone of experience aroused by the system of stimuli to which he is at the first moment of life exposed. The cry is one of general discomfort. At first this is almost the only type of reaction which stimuli call forth. Comfort and content have little positive expression; they are manifested in the quietness and silence of the infant. Expression of an active character is called forth at this stage chiefly by discomfort. The reaction is a generalized one which is the manifestation of a qualitative condition common to a variety of situations—hunger, cold, wetness, pain, etc., and the cry of the babe is at the outset practically undifferentiated.

This monotonous cry is the matrix out of which arise, first, a series of individualized but still inarticulate cries, and later the system of articulate expressions from which intelligible speech is to be constructed. Cries specifically indicative of hunger, pain, discontent, impatience, anger, differentiate from the primitive cry. The quality becomes more varied, the range increases, there is more modulation of force, and inflec-

tions begin to show among the different expressions, which nurse and mother soon learn to recognize and interpret.

4. To the primitive expression of discomfort there is also added a series of sounds expressing another quality of experience. The condition of general well-being comes to have a positive manifestation, probably connected with the increasing stability and nutritive level of the organism, in a system of movements and cries, kickings, wrigglings, rhythmical movements of the body, accompanied by cooing, gurgling, crowing, laughing and modified shrieks.

These developing expressional processes, even though regarded as spontaneous or reflex activities, and not as indicative of an experience illuminated by intelligence or differentiated emotion, do nevertheless play an important part in bringing new elements and meanings into the inner experience itself, and thereby become agencies in the general process of mental development which is going on. Even in adult life the appearance of novel forms of expression persists, and when they occur, though through sheer accident, the experience is shot through with a new sense of power and freedom. At such moments the zest of life is awakened or revived with a vigor which is literally a new quality added to its content. Such novelty, both in the form of expression and in the affective overtone which accompanies it, must be of continual occurrence in the first few years of childhood, when all experience is new, when the world rushes in at every gate of sense and thought in a tumultous flood and unceasingly calls forth reactions which reveal to the unfolding consciousness of the child a nature within itself whose richness and variety it must empirically discover as the adventurous pioneer explores the features of a land hitherto unknown.

5. The world with which the child is becoming acquainted is constituted by expression and the range of inner activity no less than by impression and outer change, and the former, or intrinsic factor, is as full of novelty and wonder as the latter. Only when its characteristic reaction is called forth does the child enter into the essential significance of an impression with which it has already grown familiar. "My own little girl," says Kirkpatrick, "was well along in her second year before she laughed aloud, and until she herself laughed was

disturbed and even frightened by the sudden laughter of others." After such an experience as is represented in the child's own laughter the recurrence of the impression no longer takes place in its former objective (and in this case terrifying) relations only, but becomes the index of a situation which is now known from within, and therefore tends to call forth at once a sympathetic reaction and to induce a congruous state of feeling. The child is now charmed and delighted by the laughter which formerly startled or even alarmed him.

6. From this primitive stage, in which experience in all its phases is almost purely affective, the child passes forward to that in which it is predominately intellectual by a continuous series of transitions. In the development of speech we are able to trace at least the gross features of this process and to point out a series of modifications which takes place in the unreflective manifestation of affective attitudes as it gives place like a dissolving view to the forms of articulate speech which succeed it.

The child's first use of true language—that is, his employment of certain modes of expression for the purpose of indicating to others his mental attitude—does not involve articulate speech. It is superposed upon his earlier spontaneous expressions of emotional states and makes use of its forms. This material of inarticulate expression is now both modified in character and transformed in significance. No longer the mere result of an existing state of mind—which it may, therefore, but in a limited way, be said to have expressed in the preceding stage—it becomes a medium for the communication of an ideal purpose. It is not a result, but a means, and its new use depends upon the rise in the child's mind of the idea of a social world and of the concept of language proper. He has grasped the thought that specific actions may be used as signs to indicate the system of meanings which he desires to express. The old cries are varied, inflected and combined in numberless ways. The series of modifications thus introduced is the result of no aimless vagary, but is specifically designed as a vehicle of communication, to attract attention, to indicate objects and to express a group of mental attitudes which call for adaptation between himself and the external

world, attitudes of curiosity, surprise, discontent, longing, dislike, and so on.

Without the aid of articulate words the child soon becomes able to make known in this way a wide range of ideas, purposes, wants and feelings. His voice perhaps now reaches a higher level of flexibility than at any subsequent stage in consequence of the continued dependence upon tone, inflection, emphasis and melody for the expression of a complex of ideas and attitudes constantly increasing in richness.

7. This short but distinct period constitutes the first stage in the history of the child's speech. His modified cries are true words—or, rather, interjectional sentences in their significance—which he employs because he finds them understood. Their use marks his entrance into the world of signs and their social value. When, after its short regime, this first medium of expression gives way before the advance of articulate speech, the child has only to substitute a new system of symbols for the old. The transition is thereby made more natural and easy, for he has already been doing the very thing which he is now to accomplish by means of the new mechanism of verbal signs.

The system of modified cries forms but a part of the total materials of expression upon which the child draws during this first period. Facial expression, gesture and general attitude combine with the voice in pointing his meaning and making eloquent his appeal. This element persists in the child's expression long after articulate speech has been so far mastered as to become his general means of communication. The vivacity of his utterance is greatly heightened by the complex accompaniment which attends his speech—the musical qualities of voice, the changes of the expressive eyes and of complexion, together with general muscular modifications. The whole flexible body is engaged in an illuminative pantomime as the child speaks, and the intelligibility of his utterance as well as its beauty owes much to this running wordless commentary.

Now, while this concomitant forms a recourse of which the child reflectively avails himself, owing to the inadequacies of his speech as an expressive medium, it is also—as it continues

to be in all natural actors—largely a spontaneous manifestation of the intellectual and emotional excitement which possesses him. It thus constitutes a true transitional phase between the primitive expression of affective experience which marks the first stage of infancy and complete dependence upon a system of conceptual signs such as written communication exemplifies.

8. The process of acquiring speech now consists in the gradual substitution of verbal expressions for this inarticulate musical utterance, with its pantomimic accompaniment. It is a task which has many difficulties and takes long to accomplish. Indeed, the substitution never attains completeness in speech itself. It is not until the development of writing that language achieves logical independence and the system of verbal concepts becomes the sole dependence of the thinker in expressing his meaning. Human speech, in its higher forms even more than in its lower, is marked by a wealth of musical qualities as well as by inflection and dramatic emphasis.

Through the addition of these supplementary media human speech is redeemed from its syntactic defects and made a living, thrilling medium for the expression of thought and emotion. Its use is also characteristically accompanied by a system of interpretative gestures which in the rudest culture is indispensable to intercourse and in the technical art of the actor attains the status of an independent medium of expression. The system of verbal concepts nevertheless constitutes the specific means by which every human being seeks to express and communicate his meaning. Putting aside, therefore, the question of its supplementation, the development of this system of concept will be approached in the next paper of this series.

(To be continued.)

MICHIGAN STATE NORMAL COLLEGE
TRAINING SCHOOL DEPARTMENT.

THE INFLUENCE OF ENVIRONMENT ON MENTAL ABILITY AS SHOWN BY BINET-SIMON TESTS.

JOSEPH WEINTROB AND RALEIGH WEINTROB,
Teachers College, Columbia University.

The relative power of nature and nurture to affect mental ability is one of those mooted points of psychology which have been interminably discussed. On the one side are men like Galton and Thorndike, who believe that a person's mental ability is congenital, that it cannot be increased during life, that training and experience can do no more than supply means for the expression of the developing ability inherently present. On the other hand, Ward, Swift and their followers hold that the human being is born with certain instincts or tendencies common to all of his species, and that the environmental influences (including under this term food, home and education) to which he is subjected determine the extent and power of his mental ability as well as the direction it will take.

What direct scientific investigation has been made on the question has been on the side of heredity only. Galton's studies showed the tendency of genius and high mental ability to occur in members of the same family, or, in other words, to be hereditary. Thorndike's tests of twins and other siblings resulted in somewhat similar conclusions. Swift's and Ward's beliefs are based mainly on observation. So far as we are aware there has been no previous attempt to test environmental influences alone. The present study is an effort in that direction.

For our purpose three groups of children were selected whose environments represented as nearly as possible types which might be classified as good, medium and poor. A brief description will best illustrate what is included under these heads. Each group consisted of 70 children of different ages

and about equal proportions of each sex. The first was taken from the Horace Mann School of Teachers College, Columbia University. These children are all from wealthy, or, at least, unburdened, families, and they have had abundant opportunities for development and self-expression, such as travel, mingling with people of culture, access to books and magazines and ample leisure time.

The second group was from the Speyer School, also of Teachers College. The Speyer School draws its pupils from the families of the wage-earner and the small-business man. There is no wealth there, neither is there great poverty. We visited the homes of more than half of the Speyer children that were tested, and found them to be fairly representative of the comfortable middle class. The children are well fed, well clothed, and have, generally, sufficient time for play, with the usual experiences of the average city child.

The third group was from the Hebrew Sheltering Orphan Asylum of New York. The children tested have been inmates of the asylum for periods of time ranging from four to ten years. Of those who are not actual orphans many were brought to the Sheltering Home by the Gerry Society because of destitution; a few have parents committed for insanity; none has had the advantages of a real home environment. In the institution itself the life is necessarily restricted by the régime of a "barrack-plan" orphanage.

These groups seemed to us to cover roughly the differences that might appear in children's lives. Ranging, as they do, from the most advantageous economic surroundings to the most barren, they should, all other things being equal, bring to light any change in mental capacity that environment might cause.

The tests used were from the Binet-Simon measuring scale for intelligence. We followed, in a general way, the revisions made by Professor Goddard of Vineland, N. J., and some of the suggestions of Terman and Childs. In a few cases we substituted our own tests for the regular ones or changed them from one year to another, but the tests as finally given were identically the same, year for year, for the children of each group. Whether or not the tests are correctly graded is a

question which did not seriously concern us. We found them, in fact, as will be seen further on, to be somewhat too easy for each year; that is, the twelve-year tests are just about suitable for the eleven-year child, and so on. But for our purpose they were admirably suited—first, because we were using them for comparison merely, so that any inaccuracies of grading would show up equally in each group; second, because the tests *are* graded, and thus give children of older ages opportunity to show intelligence of a kind different from the younger ones; third, because they test all-around mental capacity, or intelligence, rather than mere school training, and thus would be more likely to show the effects of different environmental influences which we desired to measure.

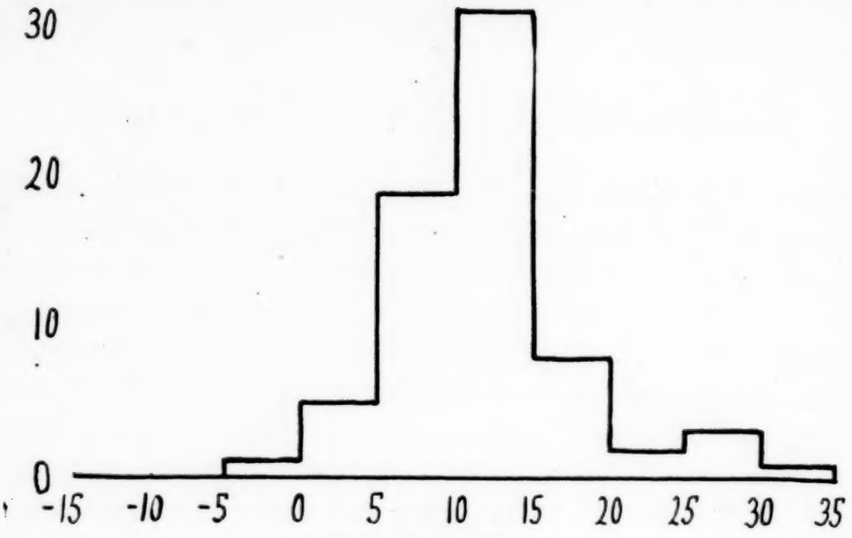
Our method of testing was to begin with each child at its physical age and carry it through three years of tests. If it was unable to pass the tests of its own age, it was taken back on the scale until the true mental age was found. In some cases children of extraordinary ability were able to go up the scale four or five years above the physical age. In registering such a score the three best years of the child's record were counted. Each single test had five possible counts: O for a complete failure, P for an answer that had an element of correctness, F for a passing mark, G for a very good answer, E for an exceptionally good answer. Table I shows the records of a few ten-year Speyer School children:

TABLE I.

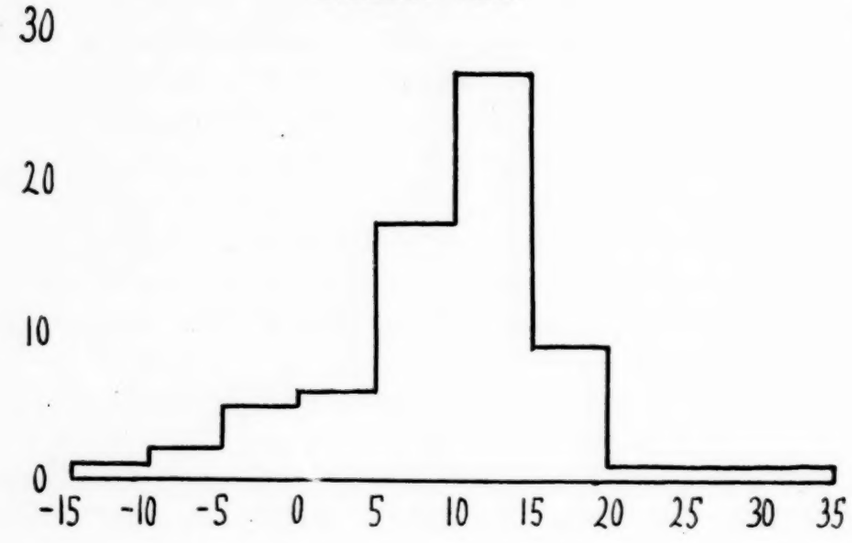
Sample of Scoring Sheet.

Individual.	IX						X						XI					XII						
	1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	1	2	3	4	5	6	7
No. 24							G	G	G	G	G	G	F	G	G	G	G	F	G	O	O	F	O	F
No. 25							G	G	F	F	G	F	O	F	F	O	G	F	O	G	O	O	O	O
No. 26	G	F	P	G	G	G	P	P	O	F	P	P	G	O	O	F	O							
No. 27							E	G	E	E	G	G	O	G	E	P	G	G	O	P	G	E	O	F
No. 28							F	F	F	G	G	F	O	O	O	G	G	O	O	F	G	G	F	O
No. 29							G	P	F	E	G	O	O	O	G	G	O	P	F	F	F	G	O	F

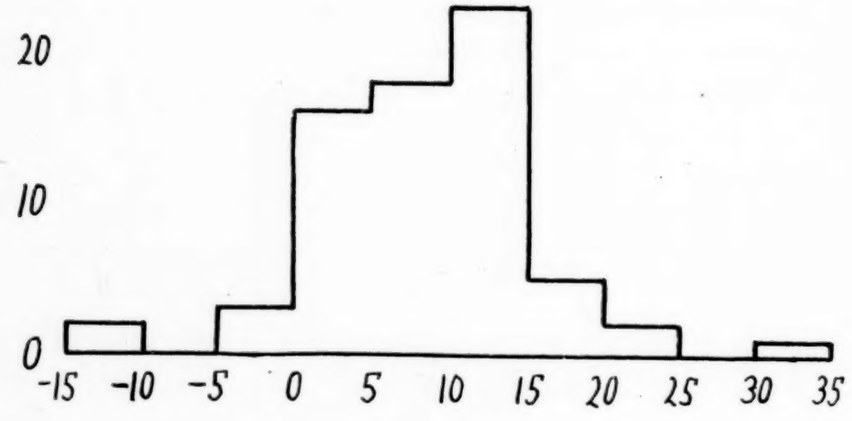
Such a system of scoring presents greater possibilities for accurate estimation of the quality of an answer, such as was needed for our purpose, than would a numerical score. For purposes of comparison, however, it was necessary to translate the results of the tests into numerical terms, and for this the following key was used:



HORACE MANN.
AVERAGE +12.67.



ASYLUM.
AVERAGE +10.48.



SPEYER.
AVERAGE +8.9.

FIG. 1.
Comparison of the three schools. The base-line in each case is the scale for achievement in the test in comparison with the average for one's age. The height above each fraction of the base line represents the frequency of that degree of achievement.

2 yr. Below.	1 yr. Below.	At Age.	1 yr. Above.	2 yr. Above.
O = −4	O = −3	O = −2	O = 0	O = 0
P = −3	P = −2	P = −1	P = +1	P = +3
F = −2	F = −1	F = 0	F = +2	F = +4
G = −1	G = 0	G = +1	G = +3	G = +5
E = 0	E = 1	E = +2	E = +4	E = +6

According to this, a final score of 0 would denote normality, that is, that the child's physical age and mental age correspond; a score of 14 would mean that the child's mental age was one year above the physical age, 25 two years above, — 5.5 one year below, — 14 two years below. (See Table II.)

TABLE II.

Sample of Scoring Sheet Translated Numerically.

Individual.	IX						X						XI					XII							Total.	Av. Score.
	1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	1	2	3	4	5	6	7		
No. 24....							1	1	1	1	1	1	2	3	3	3	3	4	5	0	0	4	0	4	38	12.67
No. 25....							1	1	0	0	1	0	0	2	2	0	3	4	0	5	0	0	0	0	19	6.33
No. 26....	0	-1	-2	0	0	0	-1	-1	-2	0	-1	-1	3	0	0	2	0								-4	-1.33
No. 27....							2	1	2	2	1	1	0	3	4	1	3	5	0	3	5	6	0	4	43	14.33
No. 28....							0	0	0	1	1	0	0	0	0	3	3	0	0	4	5	5	4	0	26	8.67
No. 29....							1	-1	0	2	1	-2	0	0	3	3	0	3	4	4	4	5	0	4	31	10.33

The results of all the tests are arranged graphically in Figure 1. The general average of the Horace Mann group was 12.67, Orphan Asylum 10.48, Speyer 8.9. The remarkable fact about these general averages is that they differ so slightly, the difference between either two contiguous groups being less than 3, or, approximately, what would correspond on our scale to one-sixth of a year of mental life. The direction of the curve in each group shows the tests to have been too easy, since the maxima should very probably have appeared two places to the left, under the 0 to 5 space; but this does not in any way affect the value of the comparison.

It will be seen that Horace Mann and the Orphan Asylum lead in the number of children scoring very high. Horace Mann has 45 with a score of 11 or above, and the Asylum 39, while Speyer has 31. On the other hand, Speyer has 39 children whose scores range comparatively low, while Horace Mann has 25, and the Asylum 31. Of those children whose scores show them to be below their physical age in mentality the Asylum has 8, Speyer 5, and Horace Mann 1.

Separating the scores into age groups (Figure 2), we find that Horace Mann children of 8 and 9 and 12 and 13 years test out higher than children of the same age of the other institu-

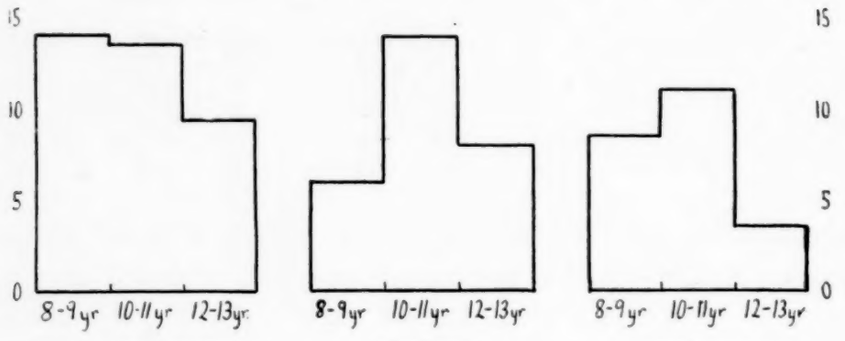


FIGURE 2.
A comparison of the results for different age-groups in the three schools.

tions. The Asylum children are slightly higher in the tenth and eleventh years. Speyer's 12- and 13-year group is very far below the others. These age-group scores, however, are not of importance, because there were not sufficient children in each group to give reliable results.

In the different phases of the tests some interesting developments occurred. The Asylum children tested highest in the use of language, the average scores of the three institutions in those tests involving the use of language, as reading, sentence building, rhyming, definitions, and filling in omitted words, being Asylum 12, Horace Mann 10.5, Speyer 7.9. Some of the tests were of ability to reason, ethical and matter-of-fact problems being considered. In these the average scores were Horace Mann 11.4, Asylum 10.7, Speyer 8. Other tests involved power of observation, sense discrimination, and counting and reckoning ability. In these the averages of the three institutions varied, no one being highest in all.

Judging from the results of these tests, then, it would seem that environment does not greatly affect mental capacity, if at all. If environment was the determining factor that its exponents argue it to be, the measuring scale for intelligence should have placed Horace Mann at the head, with an appreciable interval dividing it from Speyer in the second place, and the Asylum at the foot, with an appreciable distance between it and Speyer. Instead, the three institutions showed very small and inconsistent differences. Speyer, which should have been second, was invariably last, and Horace Mann and the Asylum, whose environmental influences are diametrically opposite, were always close together, the Asylum in many instances being ahead.

That these conclusions are not definitely established goes without saying. There were many sources of possible error in the tests which must be considered. First, the value of the Binet-Simon scale as a test of intelligence is not sure. We have already mentioned our reasons for considering it excellent for the purpose of comparing groups. The recent revisions by Terman and Childs (JOURNAL OF EDUCATIONAL PSYCHOLOGY, February-May, 1912) would tend to make it a scale for measuring school training merely rather than general mental ability, but in its previous form, with some rearrangement, it seemed to answer our purpose admirably. Second comes the matter of race. The children of the Asylum are all Jewish, mainly of Russian nationality; the children tested in Horace Mann were partly Jewish, and the rest of German, Italian, Spanish, and native American parentage, mainly the last; the children tested in Speyer were of German, Italian, and native American parentage, mainly the last. It would be difficult to find three other groups in each of which the members are living under conditions so alike as in these, but to guard against the variation which a preponderance of one race or nationality in any one group might produce each group should be composed of children of different race and nationality whose environments are as nearly alike as possible. Third, the number of children tested was small. It is quite obvious that tests of 210 children are not sufficient to definitely settle so momentous a question. Much more work along this same line, in which the difference of environmental influence is the basis of investigation, is required.

The time may come when educators, after tracing all the factors of immediate and remote ancestral heritage of any individual, will be able to determine just what sort of training will best serve to develop the powers latent within him. The present study is an effort in that direction. We shall be satisfied if it serves to throw some light, however little, upon this intensely interesting problem.

COMMUNICATIONS AND DISCUSSIONS.

A NEW ATTITUDE TOWARD THE SCIENTIFIC STUDY OF EDUCATION.

Prof. William Lyon Phelps of Yale, in his "Teaching in School and College," Macmillan, 1912, guards himself by a preface, assuring us that he does not mean to be "egotistically cocksure." His attempt to be confessional rather than hortatory is not altogether successful. The little book is, however, thoroughly readable. Spicy comments and clean-cut realistically put illustrations, with a sure sense of humor, carry the reader through the series of chapters.

His introduction, Chapter I, contains the only confessional passages, and here there is no accompanying contriteness of heart, we fear. The author's atitude toward Education as an independent branch of study is interesting. His is indeed a new attitude toward the professional student of education, more difficult to describe than the sort of mental nausea of the Fites and Shoreys. I am inclined to think that most of our academic colleagues are now to be classed with Professor Phelps. Here is their attitude (italics mine) with Phelps as their spokesman:

"Teaching is an art, not a science; and I may as well confess at the start that I *know nothing whatever of the science of pedagogy.* I am unable, therefore, *to use technical terms,* as I am not sure what they mean. I know a great many children, boys and girls, young men and maidens, but I have never studied the *psychology of the child,* and *have never attempted to find the way to a boy's heart by a scientific formula.* The science of pedagogy is today a recognized branch of learning, and there are admirable men and women who *seem to have achieved distinction in its pursuit;* but I have been too busy teaching and studying my own specialty—English Literature—to give any serious or prolonged attention to that or any other science. I am not proud of my ignorance, nor in the least disposed to slur the importance of fields of knowledge through which I have never passed. But *the study of pedagogy,* however valuable or interesting, *is not the most essential part of a teacher's intellectual or moral outfit.* One might know all about the science of pedagogy, and yet be a poor teacher of Latin, English, French or Mathematics; just as one might

be able to pass a brilliant examination on the functions of the brain, and yet not be an original or profound thinker. Perhaps the ideal combination is that suggested by Herbert Spencer in 'Education': 'Science will not make an artist. But innate faculty alone will not suffice. Only when Genius is married to Science can the highest results be produced.' The difficulty is that I, in common with most teachers of literature, have neither genius nor science. *We are forced to substitute sympathy, humor, devotion and common sense.* This book is written to help the ordinary teacher, not the inspired genius; he is a rare bird, and no pedestrian can show the way of an eagle in the air.

"My attitude toward professional pedagogy is like my attitude toward phrenology. I believe that a successful business man can tell more about a stranger's character in one interview than a professional phrenologist can by feeling of the bumps on his skull. The ablest professors of education are now employing their time and talents more sensibly than formerly; they are studying and teaching the history of education, and they are endeavoring to connect school and college in a logically progressive way."

Here we have in a foreword the treatment which characterizes the book. The chapter topics are: School Teaching and Discipline, Private School Teaching and Scholarship, Imagination in Teaching, The Efficiency of College Teaching, Education and Instruction, English Composition, English Pronunciation, Teaching English Literature, The Moral Aspect of Teaching. "Teaching is an art, not a science." The author emotionalizes and dogmatizes in a delightful personal vein. Teaching is a passion, and he instances the operations and suggests the favorable occasions for this passionate expression and communion. He is "unable to use technical terms." Throughout one fails to find any connection of his admonitions and spirited advices with a broadly conceived educational philosophy or psychology, or even administrative policy. He has "never attempted to find the way to a boy's heart by a scientific formula." The author's hallucination here is very interesting. He is running from some formula deduced from the alchemy of Herbart. He will be bound by no rule, act absolutely by inspiration, and bid everybody abandon any uniformity of procedure in teaching and as a body follow (the author's kind of?) inspiration! "We (teachers of English who know no education) are forced to substitute sympathy, humor, devotion and

common sense." The implication is that students of education have erected an ideal procedure which is a substitute for and which defies "sympathy, humor, devotion and common sense."

Into the book, which undoubtedly has the charm of an interesting and erudite personality and successful teacher, a student of education will look in vain for general principles with which to steer himself under circumstances not precisely analagous to the author's. One notes also that by subtle suggestion the author does not believe there are any such principles. This is the point of our critical comment. This is possibly what the last paragraph above may mean. Beyond a sort of patronizing and evasive acknowledgment that modern students of education may be a bit better than their pedagogic ancestors, I can find no meaning in the paragraph.

Incidentally there are many striking and some novel doctrines advanced by the author, bolstered up in the main by the successful practice of one or two eminent individuals or by reference to the author's boyhood and youth experiences, or by a case of some exceptional student in his classes. The reader will be enriched by interesting hypotheses, and will probably be stimulated to seek some more scientific assurance of their validity. Among the positions taken by the author which savor of healthy heresy, as well as naive assurance of their absolute validity, are his definite expressions on such subjects as the marking system, college examinations, imagination in the teaching of Latin, History or Mathematics, memorization exercises, classroom discipline, on theme-writing, instruction in grammar, English pronunciation, and on the Ph.D. degree standard, and the moral standard essential for teachers.

The book contributes undoubtedly, but it contributes *one wholesome person's random reactions to multitudes of pedagogical situations unclassified.* Out of dozens of books of this nature, confessional personal pedagogical autobiographies, one may hope a pedagogy of English teaching may come. This is indeed all that the author claims for his work. I have emphasized what he subtly disclaims; that is, the desirability in all subjects of the more systematic and more than personal formulation of the *specific pedagogies* of the different subjects of school and college programs of study, an undertaking which I venture to contend need not be wholly devoid of "sympathy, humor, devotion and common sense."

CHARLES HUGHES JOHNSTON.

School of Education, University of Kansas.

ABSTRACTS AND REVIEWS.

Enzyklopädisches Handbuch der Kinderschutzes und der Jugendfürsorge. Edited, with the co-operation of prominent experts, by Drs. Th. Heller, Fr. Schiller and M. Taube. Leipzig: Wilhelm Engelmann, 1911. 2 Vols. Pp. viii, 371 and 416. Mk. 34.

The field of child welfare has greatly broadened during the past two decades. Public and private philanthropy has become organized and systematized. Provision for delinquent, dependent and defective children has been accepted as a social obligation. Furthermore, we have recognized that the larger social problems set for us by the child cannot be solved by philanthropic measures alone. Modern educational investigation and modern child study have yielded a new and larger conception of the need for conserving the normal child and ensuring his optimal development. This field is now so extensive that no one person can hope to keep abreast of the developments in its numerous sections.

The editors of this encyclopedic handbook have therefore sought, with characteristic German thoroughness, to provide a manual in which every topic germane to this field shall be authoritatively discussed by an expert. The volumes are designed to provide a conspectus of the whole situation, to show what needs to be done and what needs to be known, as well as what has been done and what is known.

In all, 116 experts contribute signed articles. Our readers will recognize such names as Stern, Kemsies, Gutzmann, Maennel, Eulenberg, Burgerstein and other Continental authorities.

Some idea of the scope and nature of the work may be given by citing the following topics taken at random: Juvenile crime, handwriting, school physicians, alcoholism, Sunday-schools, deafness, vagabondage, sex enlightenment, American juvenile courts, hypnotism, coeducation, speech defects, disciplinary classes, children's testimony, scoliosis, school baths, the family, the kindergarten, infectious diseases, art education, clothing, examinations, infant mortality. The treatment of each topic is sufficiently extended to serve the needs of the ordinary reader—juvenile crime, for instance, has six pages; sleep nearly eight pages (with five charts and several tables) —and is supplemented in nearly every instance by reference to the literature.

While, for the most part, European conditions are described, and European, especially German, literature is drawn upon, the handbook is worth adding to the libraries of schools of education, teachers of education, and of institutions and specialists who are concerned with child protection and child welfare. G. M. W.

J. WELTON, M.A. *The Psychology of Education.* New York and London: Macmillan & Co., 1911. Pp. xxi, 507. $2.40 net.

This stout and attractive-looking volume is in some respects profound and in others superficial. It is profound by the grace of God through the gift to the author of a genial and well-poised personality. He writes in a cheerful vein, usually with an artist's touch, and generally with real insight into his theme. The student who has kept in intimate touch with the scholarly development of psychology and education will be somewhat disappointed that the work does not sufficiently incorporate the letter and spirit of these sciences. Both subjects have been making rapid progress in many lines of experimental research and controlled observation. They have approximated the dignity of sciences. Psycho-physics, genetic psychology and child study are particularly fertile in studies which are illuminating for education. There is almost no reference in the entire volume to any researches in these fields, and there is too marked an indisposition to profit by them.

Besides its literary excellence, there are many commendable features of the work. It is comprehensive—more so than would be indicated by the chapter headings. Psychologically, it adopts entirely the genetic viewpoint. It has outgrown the slavery of intellectualistic psychology, and prefers the "actual play of forces in real human life." "The influence of intellectualistic adult psychology is everywhere to be seen in education and is everywhere unfortunate" (p. 8). Pedagogically, too, the points of view and treatment are wholesome. The author is uncompromisingly severe with the dead formalism of educational practice. "Nothing is worth learning which is not in some sense worthy to be a permanent possession" (p. 368). He is wholly in sympathy with the vocational and occupational aspects of education. Throughout the volume it is evident that education centers in the vital intercourse of healthy personalities.

The seeming ignorance of the author of the scientific phases of psychology and pedagogy is wilful. He has a chronic aversion to the

pedantry of science. "More real insight of the kind the educator needs is to be obtained from such a profound study of human character and motive as the *Egotist* of George Meredith than from works on abstract psychology" (p. 46-7). The author accordingly prefers to devote two pages to an analysis of Sherlock Holmes on the flow of imagery rather than give any space at all to Ribot's *Creative Imagination*, or refer to the work of any "sectarian" psychologist on the topic. He has 129 quotations and illustrations from litterateurs (most of them happily selected), as against 35 from recent temporary psychologists and philosophers, and 8 from modern educators; or, to put it in another way, we find in the work entitled "The Psychology of Education" about half as many quotations from Browning as from all recent students of these topics combined; or, again, he finds more that is worth quoting upon contemporary educational matters in Shelley than in Lloyd Morgan, in Emerson than in William James, in F. M. Crawford than in Thorndike, and in Shakespeare than in Wundt.

All technical material and laborious research is left out. There is a discussion of the nervous system without the mention of Donaldson; of attention without Titchener; of character development without Dr. Bryant; of imitation without Tarde, Royce or Baldwin; of individual differences without Thorndike; of interest without De Garmo or the Herbartians; of the nature of childhood without Fiske, Butler or Oppenheim, and so on through a long list. On sex differences he has space for some flippant nonsense from Crawford, but none for the mature studies of Havelock Ellis. In discussing the stages of child life he resorts to loose description and illustration from nursery and mothers' club anecdotes and children's sayings. That "pedantic importation known as 'culture epochs'" he dismisses with a single paragraph without anywhere in the volume being aware of the good work that has been done from the empirical standpoint on *psychological* epochs. A host of names of the best students do not so much as receive honorable mention.

The eschewing of science—such is the supposedly necessary price of a literary style and an attractive treatment of the subject. That the same commodities may be purchased in other coin is amply illustrated by Huxley and Darwin in biology, James and Binet in psychology, Paulsen and Bergson in philosophy, and many writers in education. One might hope that it should become a custom to use the

artist's touch in setting forth facts and to observe the principles of aesthetics in constructing science. Professor Welton is perfectly correct in regarding fact, detail, formulas, laws and statistics, without their larger significance, as wearisome. It is equally true that it is coming to be as impossible to write on a psychological or pedagogical theme without the refinement and insight that come from a conscientious handling of details as it is in astronomy, physics and chemistry. The poetry of pedagogy, like the poetry of a symphony orchestra, must depend upon the number and variety of concrete elements that enter into it, and is in proportion to their richness and variety. It goes without saying that they must be perfectly blended and interpreted. If it is true that a piping woodwind, a scraping string or a rattling drum is not in itself music, it is equally true that the waving of the baton of a director does not constitute the symphony. There is no occasion for pedagogy either to grovel, or, on the other hand, to be satisfied with generalities.

The part of the volume that most nearly approximates a real contribution to educational psychology is Chapter IV on General Mental Endowment, in which the content of the mental life is pictured in terms of the refinement and blending of the instincts. In this chapter the author has had the patience to master the points of view of Morgan, Wundt, Hobhouse, Darwin, James, and especially Ribot on the evolution of instinct, and is able consequently to speak from deeper levels of insight. Nor is it less entertaining than Chapter XII on Ideals, for example, in which Browning, Meredith, Pope, Wordsworth, Shelley, Shakespeare and Tennyson play the leading parts in the orchestra.

EDWIN D. STARBUCK.

University of Iowa.

Graduate and Undergraduate Courses and Degrees in Education. Normal Schools and University Departments of Education. The Present Status of Education as a Science. Papers by various authors presented at the meeting of the Society of College Teachers of Education, St. Louis, Mo., February 27, 28, 29, 1912. The School Review Monographs, No. 11. The University of Chicago Press. Publications of the Society, No. 7. Pp. 153. 50 cents net.

It would be hard to treat in brief compass a group of problems more important to the college teacher of education than those covered in this monograph. Education has won its fight for recognition

as a college subject, as the existence of the Society, with 115 members, sufficiently proves, but its place in the curriculum is still so uncertain that there is great need of agreement among teachers of education themselves as to the organization of this work for both academic and professional purposes. Three aims for university instruction in education are at least distinguishable and often actually entertained: the presentation of the subject, as of general human interest, to students who do not intend to teach; the training of teachers, especially high-school teachers, and school officers, and the increase of our knowledge of fact and law in education as a distinct field of human endeavor. That is, college teachers of education are lecturing on the principles and problems of contemporary education and on the history of education to undergraduates, and in some cases to graduates, who have no immediate professional aim, and who may be taking the courses simply as part of a general academic program. They are giving technical courses to teachers, both prospective and experienced, both undergraduate and graduate, and they are conducting researches and giving research courses. The problems discussed in this monograph arise naturally out of these endeavors, and because of external hostility and indifference the solution of them is beset with more than the common difficulties attendant on the organization of a comparatively new subject.

It must be confessed that the monograph as a whole is somewhat disappointing. When a single pamphlet deals with so many subjects of first importance, perhaps this is not surprising, and the fact that this volume is, in truth, only a report of proceedings, and not strictly a monograph at all, is further extenuation; but from the titles a teacher of education is inspired with hopes which are not completely satisfied. Many of the papers are admirable, but some are very brief, inconclusive and lacking in suggestiveness. Differences of opinion on certain points are obviously due to differing conceptions of the subject treated. If the papers had been prepared earlier and exchanged among the authors, a sharper definition of issues might have resulted, and careful work by an editorial committee might have sifted the points of difference and avoided mere presentation of divergent opinion.

The differentiation of undergraduate and graduate work is treated by Professor Buchner and Professor De Garmo. Professor Buchner's long paper is interesting, if discursive, but his conclusions

ignore the difference in purpose between teacher training and general instruction in education for the non-professional student. "The distinction (between undergraduate and graduate work) points, on the one hand, to the accepted and assured *facts* about education that the undergraduate is to learn for both theoretical and practical purposes, and, on the other, to *problems* and methods appropriate in solving them which the graduate is to attack so as to return with inferences justifiable in the light of the data that are available. Put in a more practical manner, it is the difference between really preparing a teacher to teach under the conditions of the school, and carefully training the student to analyze those factors which determine the results to be secured by that teaching." But, in reality, the undergraduate, whether he is to teach or not, needs most an awakening to problems and to methods by which they may be worked out, and the graduate often needs direct training for an immediate attack on professional duties. Professor De Garmo seems to have the actual situation more presently in mind, but his paper is only an argument in the form of a brief, and is difficult to appraise.

The relation of Normal Schools to Departments and Schools of Education in Universities is discussed by Dean James, Dean Johnston and Professor Jones. The first two papers, especially Dean Johnston's, are thoroughgoing and conclusive arguments for the restriction of normal-school work to "the problems of the grades, *administrative, supervisory* and *pedagogical.*" "The university, with help from the colleges, would then work intensively upon the secondary problem * * * (and) * * * research * * *." Adequacy, economy and accessibility of instruction are given by Dean James as criteria under which the university must be adjudged the best institution for the training of high-school teachers and higher school officers. These papers deal rather with the distinction between normal-school work and university work than with the possible co-operation between the two institutions.

The three papers on undergraduate degrees in education by Professor Lough, Professor Heck and President McKeag are suggestive, but rather too brief and divergent to be as helpful as one could wish. Professor Lough expects that the Ph.D will eventually "stand not only for the mastery of a subject, but also for some acquaintance with the principles and methods of teaching it"—a reduction of the Ph.D. to a teacher's degree which will find small favor even among

teachers of education. President McKeag's able paper adds a number of valuable suggestions to Professor Lough's discussion. Professor Heck outlines in some detail a course in school hygiene.

The papers on the present status of education as a science form the most profitable portion of the pamphlet. The most helpful is that of Professor Henmon, who discusses educational psychology and urges especially more attention to the process of learning than to methods of teaching—a much-needed shift of emphasis. Professor Ruediger in a carefully-organized paper discusses the course in the principles of education, having in mind the instruction needed in a definite course for teachers—a course aiming to establish general conceptions concerning the school and the curriculum. Professor Baldwin attacks the philosophical treatment proposed by Professor Ruediger and defends a strictly scientific treatment—a development of principles directly from educational data by experiment and investigation. Obviously both are needed. He adds a list of "Selected References in the Science of Education and Experimental Education" (the latter term courts ridicule; why not say "The Experimental Study of Education?"), which is helpful, but very uneven. Professor Parker of Chicago University contributes a good article on educational methods, which Professor McMurry rather acidly criticises because it does not come to a conclusion on the scientific value of each class of principles presented.

The monograph contains much that teachers of education will find enlightening and useful, especially in the papers of Professor Heck, President Wilson, Professor Henmon, Professor Ruediger, Professor Baldwin and Professor Parker, but its greatest value is in providing a basis for discussion from which the Society may advance to standpoints which can be held with full strength against the attacks of those enraged with what Professor Henmon calls "an epidemic of *rabies paedagogorum*."

Harvard University. HENRY W. HOLMES.

L. A. ROBINSON, PH.D. *Mental Fatigue and School Efficiency: An Experimental Study in Winthrop Training School and Other Schools in South Carolina.* Bulletin No. 2, Vol. V, of the Winthrop Normal and Industrial College of South Carolina. R. L. Bryan Company, Columbia, S. C.

"The aim of this study was to obtain knowledge of the working ability of children for different periods of the single session of the

school day, and to determine the influence of mental fatigue on the working rate, together with the effects of recesses and recuperative exercises." The method followed was that of the division of subjects into groups of equal ability used by Winch and by Thorndike. All the school grades from the third to the ninth of the Winthrop Training School were used, and material in several phases of school work (arithmetic, algebra, history and Latin) was presented at periods of the beginning and the closing of the single session of school work, 9 A. M. to 2 P. M. All the tests were given by the author himself.

The first tests were short tests (three minutes) in simple arithmetic. These tests do not conclusively indicate any marked fatigue at the end of the school period in the eighth and ninth grades. They appeared to be at first conditioned by stimulative influences of novelty and fatigue, but this was offset by later practice effects. They showed no decrease in efficiency at the end of the school period—an agreement with the results of Thorndike and Ebbinghaus. Other tests of longer and more difficult arithmetic operations (five to ten minutes in length, according to the ability of the class) indicate a dropping off in ability between 12 and 1 o'clock, but the results obtained at 2 P. M. equal those of 9 A. M.

Tests were then given to investigate the loss or gain in efficiency during continuous effort. The aim was not only to determine fatigue for different parts of the hour, but also for the different hours of the day. Ten-minute tests were given in algebra, history and Latin. The results show rhythmic fluctuations in efficiency in waves of about 20 minutes. This conclusion, which may need further verification, seems to harmonize with what is known of the ordinary physiological processes, such as pulsations and respirations. In no case is the efficiency curve from morning till evening a straight line, but rather rhythmically fluctuating.

There is some illuminating study of mental inertia, mental stimulations (purposive attainment, pleasure in accomplishment and novelty) and effects of interruptions (lunches, recesses, singing and gymnastics).

The total results of the investigation are carefully summarized as follows:

(1) Individual variations appeared, but were not a primary subject of the investigation.

(2) There is no evidence of extreme fatigue or overpressure in

MICHIGAN STATE NORMAL COLLEGE
TRAINING SCHOOL DEPARTMENT.

the daily work of the children. Exceptions to this are usually caused by worry. In general, children show weariness rather than fatigue in the work, and it is therefore the teacher's problem to provide the proper mental stimulation to keep up interest in the work.

(3) Purpose, pleasure in accomplishment and interest in novelty and variety are strong and valuable stimulations.

(4) Pupils are not at a maximum of efficiency at the beginning of the session, nor after extended interruptions or too frequent changes, especially in the upper grades.

(5) Recesses are especially valuable for younger children. Short recesses (10 to 15 minutes) show improvement in the work that immediately follows them, but long recesses (25 minutes) do not, although they do afford complete relaxation from nervous strain.

(6) Gymnastic exercise for 10-minute periods benefits work which immediately follows it, but 25 minutes of folk-dancing is very damaging to immediate mental efficiency.

(7) Lunches in the five-hour school session are of no immediate benefit to mental work, but rather the reverse. Nevertheless, it is foolhardy and cruel to neglect the necessary food supply for the sake of a little mental efficiency.

(8) A 10-minute singing period increases mental efficiency.

(9) There are small variations in mental efficiency at different parts of the day, which reach a maximum at 10 to 11, show a slight drop from 12 to 1, and then take a rise until the close of the period at 2. For any particular subject, as algebra, one period seems as good as another, but alternation of easy and hard work is valuable, as it affords change and relaxation.

(10) In continuous work high and low efficiency alternate rhythmically, preventing excessive fatigue. It is important that teachers recognize these variations in working ability and adjust work accordingly.

(11) Recitation periods must be long enough to overcome mental inertia and also to take advantage of the benefits of "warming up." Prolonged attention must be cultivated also, yet it is impossible to state what should be the exact length of the recitation periods. They probably should be 40 minutes in length for high-school girls, but very much less in the lower grades.

EDGAR A. DOLL.

Vineland, N. J.

A. FRANKEN. *Ueber die Erziehbarkeit der Erinnerungsaussage bei Schulkindern.* Zeitschrift für pädagische Psychologie und experimentelle Pädagogik, 12: 1911, 635-642.

Report is a product of observation, retention, memory and linguistic ability. Previous work of the educability of report, *e. g.*, that of Oppenheim, Borst, Diehl, has left uncertain to what extent the improvement secured was distributed to each of these component factors. Franken's plan was to eliminate observation and retention and to minimize the linguistic formulation, then to test the educability of the transfer of knowledge into report. In other words, can children be taught to be more careful in stating that they do or do not know this or that thing?

His method was neat. About 100 questions were arranged which related to the school work of his subjects (150 pupils, aged 11 to 12.5 years). These questions were propounded twice, first as "decisive" and secondly as "determining" questions (*Methode der Entscheidungs-und-Bestimmungsfragen*). The first series is answered merely by "yes" or "no." For example, "Do you know on what river Lyons is situated?" The second series demands a specific answer, *e. g.*, "On what river is Lyons situated?" In one section the work was interrupted after 50 questions had been given in both forms; the pupils then checked up their own answers, and were thus made forcibly cognizant of their failings before the second 50 questions were given. In another section the experimenter simply announced, after the first 50 questions, that the second 50 questions would be followed by "control" questions (*Bestimmungsfragen*). Six possibilities may be realized for any question: it may be answered by either "yes" or "no" in the first form, and either answer may be followed by a right, a wrong, or by no answer in the second form.

The author has developed an elaborate system for scoring the data. He obtains, by computation, seven coefficients of report, viz.: range of correct knowledge, readiness of knowledge, accuracy of report, reliability of report, resistance to feeling of familiarity, and veracity. Without going into detail as to the effect of the training on the several coefficients, it may be stated that the general results of the checking by the pupils of their errors in the first half of the work, and of their knowledge that control questions would follow, appeared in a reduction of the "yes" answers. In other words, the training made them more cautious in asserting that they could answer the

questions correctly. However, the "yes-no" sequence did not entirely disappear, and still less did the "yes-false" sequence. The training was, therefore, not sufficient to destroy completely overestimation of their knowledge. "Resistance to feeling of familiarity" (*Hemmung des Bekanntheitsgefühls*) was particularly augmented in the first section of pupils. It follows that the confronting of the pupil with the demonstration of his unreliability and proneness to error has a distinct pedagogical value, and produces a greater improvement than does the mere knowledge that every assertion made will be subsequently tested by specific questions.

The reviewer believes that this method of studying report has many suggestive features. Further experiments might profitably be tried by the same method, but with the addition of various incentives to improvement which Franken purposely omitted, as, for instance, exhortation, moral appeal, rewards for cautiousness, etc.—incentives which the work of Miss Borst showed to be particularly effective in improving the reports of children. G. M. W.

A. D. SHEFFIELD. *Grammar and Thinking.* New York: G. P. Putnam's Sons, 1912. Pp. xii, 193.

The demand for a harmonized grammatical nomenclature has revealed the need for a preliminary agreement upon the content of grammatical terms, or, as the author expresses it, "a fresh appraisal of the notions that our terms presuppose." His book attempts this appraisal. It is especially interesting to note that students of linguistics are turning for aid to modern psychology and modern logic. The author acknowledges his greatest indebtedness to Wundt's *Völkerpsychologie,* and frequent references are made to William James. Successive chapters discuss the scope of grammar, the sentence rudiment, the word, the sentence as analyzed, the means of grammatical expression, terms of syntax and parts of speech, and the sentence whole. A concluding section on the place of formal grammar in elementary and secondary education is especially good. The book is well written and well organized, and its study cannot fail to furnish the teacher of language with a definite conception of the function of grammar, the lack of which has, in our opinion, often made the grammatical work of the schools quite barren of adequate results. W. C. B.

THE
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EDITORIAL.

RETROSPECT AND PROSPECT.

As the JOURNAL OF EDUCATIONAL PSYCHOLOGY approaches the end of its third year, its editors and publishers are gratified by the steady increase in esteem and support which the educational public has manifested toward it. In the coming year it will be their earnest endeavor not merely to maintain past standards of excellence, but to make the JOURNAL an even more important factor than ever in the work of the teacher and of the school.

In its original articles the JOURNAL will keep its readers in touch with the most advanced experimental work in education. Experimental ideals are being more and more generally accepted in educational circles, and the progressive educator will find familiarity with these investigations increasingly demanded. The JOURNAL OF EDUCATIONAL PSYCHOLOGY will continue to be one of the foremost organs for the publication of educational researches. Several studies of the

learning process in its various phases are in prospect, and interesting investigations in the hygiene of elementary school pupils will be reported in early numbers. Throughout the year especial emphasis will be laid upon the problems of the high school, and arrangements have been completed to have each important subject of the high-school course surveyed by a competent authority, its problems pointed out, and suggestions made as to the most promising lines of investigation.

Readers of the JOURNAL are invited to make use of the COMMUNICATIONS AND DISCUSSIONS section for the publication of queries, ideas and recommendations in regard to experimental work. Brief reports of investigations now in progress will be especially welcomed. In the ABSTRACTS AND REVIEWS section important educational works will receive detailed and critical consideration at the hands of specialists. A feature of this section will be a series of collective reviews in which the more recent contributions to each phase of educational psychology will be discussed. Educational questions of the day will be commented upon in the EDITORIAL section, and NOTES AND NEWS will chronicle current happenings in the educational world. There will be a reorganization of the CURRENT PERIODICALS section, and the editors hope to present in each number a brief and concise, but fairly adequate, *résumé* of all the important articles pertaining to educational psychology that have appeared in recent issues of scientific journals. An effort will be made to keep this section as closely up to date as possible, and thus to furnish a bird's-eye view of educational activities throughout the world. In the PUBLICATIONS RECEIVED section will be found, as heretofore, brief annotations of educational works as they come from the publishers.

With the aim of contributing more effectively to the advancement of the science of education, the Managing Editor would be pleased to receive from readers of the JOURNAL criticisms, comments and suggestions as to ways in which the JOURNAL might be made more useful and helpful to teachers. Will you not let us have the benefit of your ideas on this subject?

J. C. B.

NOTES AND NEWS.

The department of higher education of the National Education Association, through its secretary, A. R. Mead, has during the last year conducted an investigation dealing with the problem of individual training in colleges. The report bears the title, "How Our Colleges and Universities Maintain Personal Relations with the Individual Students." The compiled results are published in the forthcoming volume of the proceedings of the National Education Association for 1912. The lack of funds made the investigation a limited one, and the results must be considered as descriptive of what higher educational institutions are doing to meet the problem involved. In brief, the report indicates the prominent devices now used to attain personal relations with students, points out the need for such and shows that in some cases the problem has as yet hardly been realized.

A recent report of the director of the bureau of appointments in Oberlin College calls attention to the fact that over half of the Oberlin alumni enter the teaching profession, and suggests that greater emphasis be laid on the work of the Department of Education. He lays stress on the statement that the institution cannot adequately meet the demands put upon it without some arrangement for practice teaching under the supervision of competent instructors.

Two new courses in education have been added to the curriculum of Brown University this year. Professor Jacobs is giving a course in educational administration and Professor Colvin, who has recently come from the University of Illinois, offers a course in experimental education.

Opportunity for observation and practice teaching is now offered to students of education in the University of Wisconsin through the opening of the new University High School. There are 120 students enrolled, and the instruction is given by 16 members of the university faculty. The work of the school covers six years, taking students from the sixth grade of the elementary school, and includes physical training for all classes. Each student is given a medical examination to determine his fitness for the work.

Madam Maria Montessori will inaugurate her training course for primary teachers at Rome, January 15, 1913. The course will last four months, during which Madam Montessori will give three lec-

tures a week at her own house on the theoretical aspects of the work, and at least one morning a week will be spent in studying the practical application of the method in the municipal or other schools in Rome, where it is taught.

Dr. J. E. W. Wallin, director of the psychological clinic in the University of Pittsburgh, has been appointed R. B. Mellon Fellow in the division of smoke investigation in the department of industrial research of the university, with the immediate duties of making a preliminary survey of the literature bearing on the psychology of smoke, and of outlining a plan of investigation in this field. Owing to the lack of bibliographies bearing on this topic, he will be pleased to receive statements from anyone who has made observations on the mental influences of smoke, or who is in a position to supply references.

The psychological laboratory at the Sorbonne, founded and for many years directed by the lamented Alfred Binet, will be conducted by Prof. H. Piéron. The *Année Psychologique,* the current number of which has been prepared by Simon and Larguier des Bancels, will be continued under Professor Piéron's editorship.

John Madison Fletcher, Ph.D., has been appointed assistant professor of experimental and clinical psychology at the Newcomb College School of Education, Tulane University.—*Psychological Bulletin.*

Prof. E. C. Wilm of Washburn College has accepted the professorship of philosophy and psychology at Wells College.

Dr. Edward Thompson Fairchild of Lawrence, Kans., superintendent of public instruction of that State and president this year of the National Education Association, has been elected president of the New Hampshire College.—*Science.*

Dr. Herbert H. Woodrow, instructor in psychology at the University of Minnesota, has been promoted to the rank of assistant professor in that institution.

Samuel Weiller Fernberger, Ph.D., instructor in psychology in the University of Pennsylvania, has accepted a similar position at Clark University.—*Science.*

Mr. F. C. Ayers of the University of Chicago has been made head of the department of education at the University of Oregon.

CURRENT PERIODICALS.

(In this section only such articles will be noticed as bear directly or indirectly upon the interests of this Journal.)

REVUE PSYCHOLOGIQUE. Vol. IV, No. 2, June, 1911. E. VINCK. *The Rights of the Child from the Point of View of the Law.* 169-178. The author points out a number of absurdities in the French law in regard to children.

AUG. LE C——. *Contributions to Physical and Mental Paidology.* 178-211. A detailed study of the development of three little girls in the same family. There are elaborate tables of physical measurements by years and a very interesting application of the Binet scale (1908) to determine the mental age of the children.

LEON TOMBU. *Aptitudes for Drawing.* 211-213. In art one must distinguish between skill in execution and breadth of conception. Many great painters have possessed only indifferent skill in drawing, but where the aptitude for this is present it frequently shows itself very early in life by the delight which the child takes in drawing.

I. IOTEYKO. *Alimentary Illusions.* 214-252. A brilliant discussion of the psychology of foods and feeding. The illusions are classified as (1) sensorial, (2) visceral, (3) cerebral and (4) calorific. The author is a radical vegetarian and focuses all the acumen of her psychological analysis upon the task of showing that the arguments for a meat diet are fallacious.

No. 3, September, 1911. O. DECROLY. *Presidential Address at the Opening of the First International Congress of Paidology.* 284-289. An interesting account of the development of psychology and paidology in Belgium.

M. C. SCHUYTEN. *On the Importance of the Paidological Sciences.* 290-294. Address at the opening of the first international congress of paidology. The speaker emphasizes the almost total neglect of the scientific study of the child up to the last two decades, and the rapidity with which interest in the subject is now awakening.

I. IOTEYKO. *Opening Address at the First International Congress of Paidology.* 295-300. A sketch of the developments in psychology and pedagogy which contributed to the new science of paidology and led to the organization of this congress.

W. BECHTEREW. *Social Psychology Considered as an Objective Science.* 301-313. The distinguished Russian neurologist considers social psychology as a study of neuro-psychic reactions in a social environment. He distinguishes it sharply from "Völkerpsychologie," individual psychology and sociology, and emphasizes the study of national character and types of activity. Social psychology includes the domination of the individual by the group, but also the enfranchisement of the individual in his intellectual development.

I. IOTEYKO. *The Life of Psychic Elements.* 317-327. This is a continuation of a previous article in which mental life is conceived as a biological phenomenon with a struggle for existence and sur-

vival of the fittest among the elements of experience. In the present article the phenomena of dissociation and the facts brought to light by psychoanalysis are considered from this point of view. There follows a discussion of the laws of forgetting in their relation to the lapse of time.

No. 4, December, 1911. H. LORENT. *A Synthetic Method of Drawing from Nature.* 345-357. Drawing is a matter of visual perception and motor co-ordination. The method here proposed lays emphasis on the sketch from life. Standing at some distance from the object to be drawn the pupil passes the end of the finger or the tip of the pencil several times over the outline of the model to be drawn. When the movements involved have become closely associated with the visual percept, they are made once more with the pencil touching the paper. This direct translation of visual impression into co-ordinated movements is said to give great accuracy and vividness to pupils' drawings.

I. IOTEYKO AND V. KIPIANI. *Role of the Muscular Sense and of Vision in Writing.* 357-361. The authors contend that it is wrong to train children to fix their eyes on what they are writing. It is a source of fatigue, and may contribute greatly to myopia. Experiments with the blind, with normal persons blindfolded, with writing at arm's length and with writing when the head is raised show that the speed is increased and the quality suffers very little when the role of vision is reduced to merely keeping on the line. In writing practice we should, therefore, encourage pupils to develop muscular control, and to depend on vision as little as possible.

I. IOTEYKO AND V. KIPIANI. *Role of the Muscular Sense in Drawing.* 362-369. The part played by the muscular sense in drawing was tested experimentally with 80 subjects by having them first draw an object with eyes open, then reproduce the object with eyes closed. There were three groups of experiments: (1) geometrical figures; (2) a butterfly with outspread wings and an imaginary profile, and (3) a drawing from life (vase, glass of water, fountain, gas lamp, etc.). In some cases the geometrical forms were as well drawn with eyes closed as open. The greater the number of details in the other drawings, the greater the simplification which appeared with eyes closed.

VARIA KIPIANI. *The Gymnastic Alphabet.* 370-372. The author refers to Montessori's use of touch in teaching reading, and urges greater use of the muscular sense. This can be done by having the children trace the letters of each word with the finger, either in the air or on paper.

I. IOTEYKO. *Report of the First International Congress of Paidology.* 378-414. A fairly detailed abstract of each paper presented at the congress. The abstracts were prepared by the general secretary.

G. SAINT PAUL. *Questionnaire on Internal Language and on Public Speaking.* 415-421. An interesting questionnaire on the factors that contribute to power in oratory.

PUBLICATIONS RECEIVED TO NOVEMBER 1.

(Notice in this section does not preclude a more extended review.)

BERTHA MILLARD BROWN. *Health in Home and Town.* New York: D. C. Heath & Co., 1912. Pp. vi, 312.

This excellent little book will give pupils of the upper elementary grades a good idea of the conditions necessary for healthful living. There are 11 chapters on the construction, furnishing and management of the home, and a like number on home surroundings, city food and water supplies, care of city waste and the diseases incident to city life. The style is simple and forceful, the author is familiar with and makes use of the latest scientific materials, and the attractiveness of the verbal narrative is enhanced by the abundance of well-chosen illustrations. There is a helpful series of bibliographies for the teacher and a good index. The book is a valuable addition to the texts on wholesome living, and should find wide adoption and use in the schools.

H. A. BROWN. *The Readjustment of a Rural High School to the Needs of the Community.* Washington: Bureau of Education, 1912. Bulletin No. 492. Pp. 31.

With all the current insistence upon the necessity of better rural education, opinions are far from unanimous as to the desirable content of such education in its higher phases. This account of the equipment and course of study of the Colebrook (N. H.) Academy is a helpful contribution to the subject.

BAILEY B. BURRITT. *Professional Distribution of College and University Graduates.* Washington: Bureau of Education, 1912. Bulletin No. 491. Pp. 147.

An intensive study of the history of professions in 10 colleges and universities, and statistics of the professional influence of 37 representative institutions.

MARY WHITON CALKINS. *A First Book in Psychology.* New York: The Macmillan Company, 1912. Pp. 426.

"The present revision of this book has been made with three main ends in view: To emphasize the essentially social nature of the conscious self; to accentuate the fact that the study of the self, as thus conceived, involves a study of behavior, and finally to prune the book of expressions which lend themselves to interpretation in terms of an atomistic psychology." (Preface.)

ARTHUR JEROME CULLER. *Interference and Adaptability; An Experimental Study of Their Relation with Special Reference to Individual Differences.* Archives of Psychology, No. 24, July, 1912. Pp. 80. Cloth, $1.

If an association be formed between a stimulus and a response,

and later another response be associated with the same stimulus, to what extent will the second association interfere with the first? What individual variations does this interference manifest? What is the effect of continued repetition upon such interference? These problems, experimentally investigated in the present monograph, are obviously of prime importance to education, and the discussion merits detailed study by educational psychologists.

SIGMUND FREUD. *Selected Papers on Hysteria and Other Psychoneuroses.* Translated by Dr. A. A. Brill. New York: The Journal of Nervous and Mental Disease Publishing Co., 1912. Pp. 125.

A revised edition enlarged by two chapters, one "On Wild Psychoanalysis" and another "The Future Chances of Psychoanalytic Therapy."

WILLFORD I. KING. *The Elements of Statistical Method.* New York: The Macmillan Company, 1912. Pp. 250.

A very elementary statement particularly adapted to the sociological sciences.

F. M. LEAVITT. *Examples of Industrial Education.* Boston: Ginn & Co., 1912. Pp. viii, 330.

This is perhaps the best brief systematic account of vocational and industrial education that has thus far appeared in America. The demand for industrial education is treated in four chapters devoted, respectively, to the demand from manufacturers, from organized labor, from educators and from social workers. Plans for reorganizing the present educational system in the direction of vocational efficiency are discussed in two chapters. The remainder of the book (with the exception of a chapter on legislation) is devoted to an account of different types of vocational education. A feature of the treatment is a detailed presentation of the organization, administration and curriculums of typical schools. At a time when changes are being made so rapidly that even the special student may easily miss a link in the chain of causes and effects a book of this sort will be gratefully received.

A. T. POFFENBERGER, JR. *Reaction Time to Retinal Stimulation, with Special Reference to the Time Lost in Conduction Through Nerve Centers.* Archives of Psychology, No. 23, July, 1912. Pp. 73. Cloth, 95 cents.

An interesting study of the neural basis of response to visual stimuli.

J. G. ROBERTSON. *Goethe and the Twentieth Century.* New York: G. P. Putnam's Sons, 1912. Pp. 155. 40 cents net.

A brilliant discussion of the genius of Germany's great nineteenth century poet, and his influence upon the thought of the twentieth century.

WALTER SARGENT. *Fine and Industrial Arts in Elementary Schools.* Boston: Ginn & Co., 1912. Pp. vi, 132.

The first chapter is a thoroughly admirable presentation of the educational value of drawing. We can recall no treatment, by a specialist, of the pedagogy of a special subject which is so clear and sane upon the question of general educational values. Chapter II furnishes a survey of the drawing work through the elementary grades. The following chapters discuss the grade work in detail. This book will be a first-hand help to superintendents and principals who are often handicapped in the general supervision of the "special" subjects, such as drawing, music, manual training and domestic science. Similar monographs in the remaining subjects of this group would be equally useful.

ANNA TOLMAN SMITH. *The Montessori System of Education. An Examination of Characteristic Features set forth in Il Metodo della Pedagogic Scientifica.* Washington: Bureau of Education, 1912. Bulletin No. 489. Pp. 30.

A sympathetic interpretation of the essential Montessori doctrines and a summary of the opinions of prominent English and American educators on the movement.

STEVENSON SMITH. *First Annual Report of the Bailey and Babette Gatzert Foundation for Child Welfare.* Bulletin of the University of Washington, No. 60, 1912. Pp. 15.

The most interesting part of this report is the statement by the director of the foundation regarding the diagnosis of cases which have come before the Juvenile Court of Seattle. In this a question is raised regarding the efficacy of the probation system in the treatment of criminals.

THEODATE L. SMITH. *The Montessori System in Theory and Practice.* New York: Harper & Bros., 1912. Pp. ix, 78. 60 cents net.

One purpose of this little book is "to call the attention of teachers to the principles (of the Montessori system) that are applicable under American conditions, in distinction from incidental results which, though occurring among Italian children, are not possible in a *non-phonetic* language." The statement that the Montessori material is based on "results of scientific experiment, and all that modern psychology has discovered in regard to the development of the senses and intelligence," will surprise educational psychologists who have carefully studied Madam Montessori's book. One of the striking features of that book is the nonchalance with which modern investigations in educational psychology have been almost completely ignored.

JOHN WELHOFF TODD. *Reaction to Multiple Stimuli.* Archives of Psychology, No. 25, August, 1912. Pp. 65. Cloth, 85 cents.

The reaction time to two or more simultaneous stimuli is shorter than to any one of them alone. There is an interesting chapter on reinforcement and inhibition.